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The Gift of

WILLIAM H. BUTTS, Ph.D.

A.B. 1878 A.M. 1879

Teacher of Mathematics

1898 to 1922

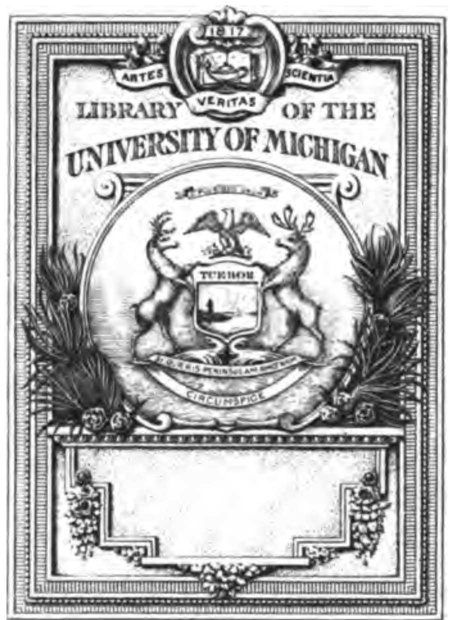
Assistant Dean, College of Engineering

1908 to 1922

Professor Emeritus

1922

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PHILIPPI LANSBERGII

TRIANGULORUM GEOMETRIÆ

LIBRI QUATUOR;

In quibus novâ & perſpicuâ methodo, & ἀποδείξει tota ipſorum Triangulorum doctrina explicatur.

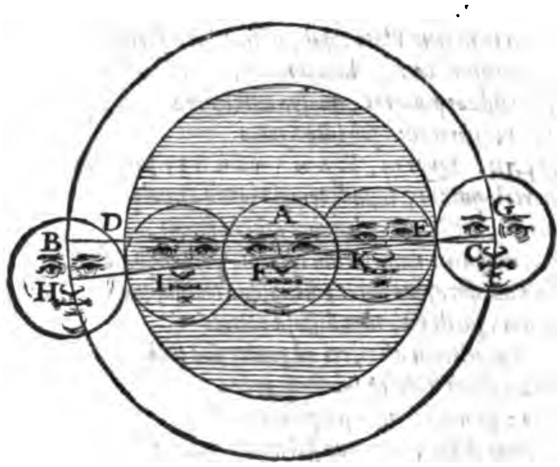
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PHILIPPI LANSBERGII

CYCLOMETRIÆ NOVÆ

LIBRI DUO.

Ab Autore recognita, multiſque in locis aucta.



MIDDELBVRGI ZELANDIÆ,

Apud *Zachariam Roman*, Bibliopolam.

cIↃ IↃ C ·IIII.

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IN PHILIPPI LANSBERGII TRIANGULORUM GEOMETRIAM IANI DOUSÆ FILII CARMEN.

Felix ille animi nimis, egregiusque laboris,
Quem juvat assiduè niti præstantibus ausis,
Possit ut infectas terrai exscindere pestes,
Et penitus patrio mentem defigere cœlo.
Namque illum æterni Patris indulgentia major
Linquentem terras & sidera mente sequentem
Excipietque polo, & fulgentibus inferet astris.
Crediderim haud aliter priscos agitasse parentes,
Qui primi astrorum leges atque ætheris omnes
Reclusere vias; & Mundi flammea tecta
Accessere acie mentis, doctamque per artem
Orbibus affixere suis palantia signa.
Abrahamus. *Qualis & ille * Senex, structâ cui filius arâ*
Mactandus sedit; & Sethi antiquior illo
Progenies duplici cœlum scrutata columnâ.
Nec non Caucaseâ pendens de rupe Prometheus,
Qui tenuem nitidis ignem furatus ab astris
Finxerat humanos glebaque & flumine vultus.
Et tu, quem Oetea rapuere ad sidera flamma
Atque tuo quondam libratum vertice cœlum.
De *Hercule Astrologo* vide Festum. *Tum * cui conspicuam erexit statuam Attica tellus,*
Et voluit fulvo linguam fulgere metallo.
Berosus. *Ut taceam te magne Plato, qui, ut in æthera ferret*
Sublimes oculos, homini data lumina, dixti.
Ac tot Chaldæos proceres, quosve extulit ora
Assyriæ, vel ubi mediâ sub luce Syenes
Umbra perit. Quos tu, LANSBERGI, *ponè secutus*
Nil mortale putans, liquidi templa ignea Mundi
Percurrens, stellisque ardentibus æthera fixum,
Tam certis spatiis numerorum includis Olympum, &
Momina mensurasque doces, flexusque recessusque
Innumeros; facili tot, tam diffusa coerces
Gyro; ut proclivem astriferi ad penetralia cœli
id est Arithmeticæ & Geometriæ. *Ostendas callem * doctâ subnixus arena*
Remigio; sic non humeris sed pectore cœlum
Fulciit altus Atlas; nec equo sed mente volavit
Atque animi pennis liquidi ad confinia Mundi
Bellerophon. *Ille, Chimeræas potuit qui vincere flammas.*
Nobilis & summo nunc splendet in æthere Perseus
Gorgonis anguicomæ domitor, qui nubila supra
Ventorumque leves animas & fulmina vectus
Ingenio accessit Superûm tonitralia templa.

Ad

EES

Ad Amplissimos & Magnificos Viros,

CONSULES,

Totumque inclytæ Middelburgensium Reipub.

SENATUM,

Dominos suos plurimùm observandos.

PHILIPPUS LANSBERGIUS.

ADFERO vobis Amplissimi Viri, libros, quos de Triangulorum Geometria quos primùm in urbe vestra concepi, post Goesæ scripsi, & perscripsi; nunc verò, quantâ à me fide potuit, & deligentiâ recognovi. Sed quod scriptores ferè omnes in operum suorum præfationibus facere consueverunt; ut & lucubrationum suarum rationem, & dedicationis causas exponant; id mihi potissimùm faciundum duxi. Iam nunc enim mihi illos audire videor qui me & imprudentiæ, & temeritatis accusent. Imprudentiæ quidem, quòd eam Geometriæ partem explicandam susceperim, in cujus demonstratione feliciter laborarunt non pauci ex priscis Mathematicis; & quam nostro etiam seculo multi magnique viri scriptis suis illustrarunt: temeritatis verò, quòd primum hunc, rudemque ingenii mei fœtum, Amplitudini vestræ offerre ausus sim. Sed facilis erit utriusque criminis dilutio, apud eos, qui rem ipsam æstimare, & cæcos animi affectus (interea dum ipsis respondero) deponere voluerint.

Quod ad primum, hoc sanctè affirmo, non eo animo laborem hunc nobis susceptum esse, ut eorum monumenta qui ante nos scripserunt, & immortalitati consecrata sunt, aut improbemus, aut è manibus studiosorum abducamus: Veneramur enim, & suspicimus omnes, qui in hoc scribendi genere versati sunt; imò aliorum scriptis non mediocriter adjutos esse ingenuè fatemur: Ingenui enim est (ut inquit ille) fateri à quo profeceris. Sed quia plærique ita scripsere, ut doctioribus tantùm scripsisse videantur; & fu-

fuſiùs quàm ut exiguo tempore perlegi poſſint: non inanem operam poſiturum me putavi; ſi rudiores inſtituendos deligerem, & compendio doctiores juvarem. Feci igitur quantum potui; nihil ad oſtentationem, nihil invidiæ cauſâ: hic unus mihi ſcopus propoſitus ut multis prodeſſem. Quod ſpero me aſſequutum eſſe: etſi enim de utilitate operis, laboriſque mei, alios; non me verba facere oporteat: hujus tamen plus ſe hinc cepiſſe fatebitur Lector Philomathes (ſi animum intenderit) quam ego verbis verecundè ſpondere auſim.

Cæterum quod in nomine veſtro, hanc meam lucubrationem lucem adſpicere voluerim; nemo temeritati tribuat: nam ut hoc facerem, multæ mihi graveſque cauſæ fuerunt. Prima, quòd illiberabilis & ingrati animi eſſe judicabam, hoc mei ingenii fœtu in veſtrâ urbe primùm formato, Amplitud. V. tanquam ſeminis veſtri proventu malignè ſpoliare. Altera, quòd ſi labor hic noſter literariæ Reipublicæ utilis futurus eſſet, ſub veſtro nomine longè gratiſſimum futurum putabam. Nam ut Amplitud. V. glorioſum eſt; ita ſtudiis cum primis utile, tantos viros Mathematicarum artium patronos eſſe. Poſtremo veſtra illa in bonos humanitas, & maximè eos, quos aliquod doctrinæ nomen commendat aut literarum, impulit me, ut viciſſim ego hoc gratitudinis officio, meam erga vos voluntatem fidemque teſtarer. Quapropter cùm tot tantæque mihi cauſæ munuſculi mei Amplitud. veſtræ offerendi fuerint; ut pro veſtra ſumma æquitate benignè accipiatis, & certiſſimum meæ erga vos univerſos & ſingulos obſervantiæ μνημόσυνον eſſe ſtatuatis, obnixè rogo: Ita enim laboris operæque meæ uberrimum fructum percepiſſe videbor. Valete Ampliſſimi & Magnifici Viri. Goeſæ, III Kalend. April. Anno Chriſti CIↃ IↃ XCI.

G E-

GEOMETRIÆ TRIANGULORUM

LIBER I.

De magnitudine rectarum linearum quæ circa Circuli peripheriam considerantur.

1.

TRIANGULORUM Geometria est, quæ ex tribus quibuscunque, vel angulis, vel lateribus, in rectilineo aut Sphærico Triangulo datis, reliquorum laterum angulorumque dimetiendorum rationem tradit, adminiculo Canonis Triangulorum, ex magnitudine rectarum linearum, quæ circa circuli peripheriam considerantur, compositi.

Suscepta nobis est explicanda Triangulorum Geometria, rectè igitur à definitione ejus auspicamur: omnis enim quæ à ratione suscipitur de aliqua re institutio, debet à definitione proficisci, ut intelligatur id de quo disputatur. Definitio autem præmissa cum à partibus totius doctrinæ sumpta sit, valdè clara est, & sigillatim deinceps demonstrabitur.

ΠΟΡΙΣΜΑ.

Ejus itaque partes tres sunt. Prima ex primis Geometriæ elementis, rectarum linearum magnitudinem, quæ circa circuli peripheriam considerantur, demonstrat: Altera Canonis Triangulorum σύνταξιν: Postrema, usum ejus in calculo Triangulorum rectilineorum, & Sphæricorum.

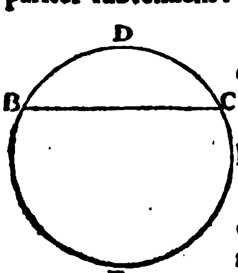
2. Rectarum verò linearum quæ circa circuli peripheriam considerantur, aliæ sunt in circuli peripheria, aliæ extra, aliæ per circuli peripheriam.

Veteres Mathematici cùm solis subtensis in Triangulorum Geometria uterentur, rectarum solummodo magnitudinem quæ in circulo sunt investigabant. Nobis verò cùm plenior, planiorque mensurandi ratio explicanda sit, etiam earum quæ extra & per circuli peripheriam sunt, magnitudo demonstranda est.

De magnitudine rectarum in Circuli peripheria.

3. In circuli peripheria considerantur Subtensa, & Sinus.

4. Subtensa est recta linea in circulo, dirimens eum in duo segmenta; & utrumque pariter subtendens.



Talis est in adjecto schemate recta B C. *dirimit enim circulum* B D C E *in duo segmenta*, B D C *&* B E C: *& utrumque pariter subtendit.*

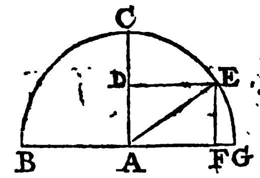
5. Sinus, est recta linea in semicirculo, ab arcus termino perpendicularis.

Vox Sinus Arabica est, & proinde barbara; sed cum longo usu approbata sit, & commodior non suppetat, nequaquam repudianda est: faciles enim in verbis nos esse oportet, cùm de rebus convenit.

6. Sinus rectus est aut versus.

Recentiores aliqui Sinum dividunt in primum & secundum: nam cum ex præmissa Sinus definitione, versus non minus perpendicularis sit quàm rectus, etiam rectum esse contendunt, & proinde vitiosam distributionem Philosopho ubi partes conveniant. Verùm cum hoc verso Sinui proprium sit, quod recto versus sit, rectus solummodò κατά τι; nulla caussa est ab usitata divisione recedendi.

7. Sinus rectus est recta linea in semicirculo, ab arcus termino perpendicularis in diametrum, dividens semicirculum in duo segmenta; ad quorum utrumque pariter refertur.



Talis est in adjunctâ figurâ recta E F; *est enim ab* E *arcus termino, perpendicularis in diametrum* BAFG; *dividitque semicirculum* BCEG *in duo segmenta*, G E, *&* B C E, *ad quorum utrumque pariter refertur.*

ΠΟΡΙΣΜΑ.

Itaque Sinus rectus, est semissis Subtensæ arcus dupli.

Nam quod Subtensa est in circulo, id Sinus rectus est in semicirculo, quemadmodum definitiones Sinus recti & Subtensæ, inter se collatæ ostendunt.

8. Sinus rectus peripheriæ, & complementi sui æquepossunt radio.

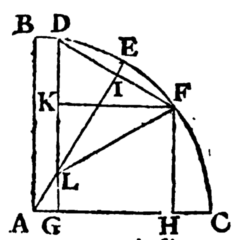
Complementum peripheriæ dicimus reliquam peripheriam datæ ad circuli quadrantem. Sit igitur in præmissa figura, recta E F, *sinus rectus peripheriæ* G E *vel* B C E: *& complementi sui* C E *sinus rectus* E D, *vel æqualis illi* A F *per trigesimam quartam primi elementorum. Dico* A F *&* E F, *æquepossе radio* A E. *Nam per penultimam primi Euclidis, in Triangulis rectangulis, quadrata laterum rectum angulum continentium, æqualia sunt lateri rectum angulum subtendenti. Sed* A F E *est Triangulum rectangulum ad* F *per septimam hujus, crura verò rectum ambientia sunt* A F *&* E F: *æquepossunt ergo radio* A E *rectum angulum subtendenti; quod erat demonstrandum.*

ΠΟΡΙΣΜΑ.

Itaque dato radio cum sinu recto peripheriæ, datur etiam sinus rectus complementi sui: dempto enim sinus noti quadrato ex quadrato radii, relinquitur quadratum sinus complementi; cujus radix est ipse sinus quæsitus.

In exemplo sit radius A E 10, *&* E F 6; *erit* D E 8: *ablato scilicet quadrato* E F 36, *ex quadrato radii* A E 100, *& residui* 64, *quadrato latere* 8 *assumpto.*

9. Differentia Sinuum rectorum peripheriarum duarum, à circuli sextante æquali intervallo remotarum, æquatur Sinui recto peripheriæ alterutrius, à circuli sextante intervalli.



Sint in quadrante A B C *peripheriæ duæ* C F *&* C D, *æquali intervallo ab* E *circuli sextante remotæ; & harum recti sinus* F H *&* D G: *differentia verò sinuum* D K. *Dico* D K *differentiam sinuum rectorum peripheriarum datarum, æquari* D I *vel* F I, *alterutrius peripheriæ à circuli sextante intervalli: Triangulum enim* D L F *est æquiangulum (nam* D L *latus Trianguli rectanguli* D I L, *æquatur* L F *lateri Trianguli rectanguli* F I L *per quartam primi elementorum: & proinde anguli ad* D *&* F *in Triangulo* D L F *per quintam ejusdem æquales sunt) Sed angulus* D L E *est partium* 30, *æqualis scilicet angulo* B A E *per secundam & quintam sexti elementorum: totus itaque* D L F *est partium* 60. *Talium verò etiam est angulus ad* D *&* F *sigillatim per trigesimam secundam primi elementorum. Quare cùm Triangulum* D L F *æquiangulum sit; etiam æquilaterum est per quintam ejusdem: & proinde latus* D F *æquale lateri* D L; *& semissis illius* D E *per decimam primi elementorum, æqualis semissi hujus* D K: *quod erat demonstrandum.*

ΠΟΡΙΣΜΑ.

Quare, si duarum peripheriarum, æqualiter à circuli sextante remotarum, recti sinus dentur, etiam distantiæ peripheriæ alterutrius à circuli sextante rectus sinus innotescet; differentia enim sinuum datorum, est ipse sinus quæsitus.

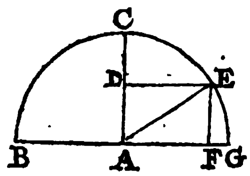
In exemplo esto peripheria C F *partium* 50, *distans ab* E *circuli totius sextante partibus* 10; *& ejus rectus sinus* F H 7660: *peripheria verò* C D, *partium* 70, *simili intervallo ab* E *remota; & sinus rectus ejus* DG 9396. *Differentia sinuum* DK 1736, *æqualis est sinui recto arcus* EF *vel* ED, *partium* 10.

Quod si rectus sinus peripheriæ alterutrius, cum sinu recto distantiæ notus sit, etiam reliquæ peripheriæ rectus sinus invenietur: ablato enim sinu recto peripheriæ distantiæ, ex sinu recto peripheriæ sextante circuli majoris, relinquitur sinus rectus peripheriæ minoris; adjecto vero eodem sinu distantiæ ad sinum rectum peripheriæ sextante circuli minoris, componitur sinus rectus peripheriæ majoris.

In eodem exemplo auferatur sinus rectus distantiæ F I, *vel æqualis ei* D K 1736, *ex* D G 9396, *sinu recto peripheriæ* C D, *circuli sextante majoris; relinquitur* K G, *vel æqualis illi* F H *per trigesimam*

ſimam quartam primi element. 7660, *ſinus rectus* C F *peripheriæ minoris. Addantur viceverſa in unam ſummam ſinus rectus* D K 1736, *& ſinus rectus* F H, *vel* K G, 7660; *componitur ſinus rectus* D G 9396, *competens peripheriæ* C D, *ſextante circuli majori.*

10. Sinus verſus, eſt recta linea in ſemicirculo, ab arcus termino altero, ad ſinum rectum perpendicularis.



Talis eſt recta G F, *eſt enim perpendicularis ab altero termino peripheriæ* G E, *nempe* G, *in ſinum rectum* E F. *Item* B F: *nam & ea perpendicularis eſt à peripheria* B C E, *termino altero* B, *ad* E F *ſinum rectum peripheriæ ejuſdem.*

11. Sinus peripheriæ verſus, & complementi ſui rectus æquantur radio.

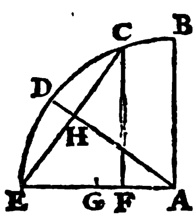
Sic in figura ſuperiori, recta F G, *ſinus verſus peripheriæ* G E; *&* A F, *ſinus rectus complementi ſui æquantur radio* A F G. *Nam per communem ſententiam, Totum æquale eſt omnibus partibus ſuis ſimul ſumptis.*

Π Ο Ρ Ι Σ Μ Α.

Proinde radio dato, & ſinu recto complementi peripheriæ, datur ipſius peripheriæ ſinus verſus. Dempto enim ſinu recto complementi peripheriæ ex radio, relinquitur ſinus verſus peripheriæ datæ, quadrante circuli minoris: adjecto vero ſinu recto exceſſus peripheriæ ſuper circuli quadrantem ad radium, componitur ſinus verſus peripheriæ datæ; quadrante circuli majoris.

In exemplo detur radius A G 10, *&* A F 6, *rectus ſinus peripheriæ* E C. *complementi* E G *ad circuli quadrantem: erit* F G 4, *ſinus verſus peripheriæ* E G, *quadrante circuli minoris. Rurſus, ſit* C E, *exceſſus peripheriæ* B C E, *ſuper circuli quadrantem* B C; *& ſinus rectus ejuſdem* D E *vel* A F 6, *radius* A B *ut ſupra* 10: *erit* B A F 16, *ſinus verſus peripheriæ* B C E. *quadrante circuli majoris.*

12. Sinus rectus & verſus, æquepoſſunt ſui arcus ſubtenſæ.



Sit in quadrante B C D E, C F *ſinus rectus arcus* C E; E F *ejuſdem peripheriæ ſinus verſus: & Subtenſa ejuſdem* C H E. *Dico,* C F *ſinum rectum, &* E F *verſum, æquari* C H E, *ſubtenſæ arcus ſui* C D E. *In rectangulis enim triangulis per penultimam primi Elementorum quadrata laterum rectum ambientium, æquantur quadrato lateris recto angulo oppoſiti: Sed Triangulum* C F E, *eſt rectangulum ad* F *per ſeptimam hujus: Latera verò rectum ambientia ſunt ſinus* C F *&* E F; *oppoſitum recto angulo latus eſt* C E, *ſubtenſa arcus* C D E. *Itaque quadrata ſinuum* C F *&* E F, *æquantur quadrato ſubtenſæ* C E: *quod erat demonſtrandum.*

Π Ο Ρ Ι Σ Μ Α.

Quare cujuſvis peripheriæ recto ſinu, & verſo cognito, invenitur & ſubtenſa ejus; & ſinus rectus peripheriæ dimidiæ: quadrati enim recti ſinus, & verſi peripheriæ aggregati radix, datæ peripheriæ ſubtenſa eſt; & ſemiſſis ejus, eſt ſinus rectus peripheriæ dimidiæ.

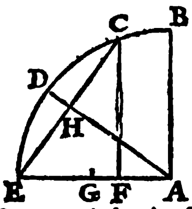
In exemplo ſit E F 6, *&* C F 8: *erit* C H E *ſubtenſa*, 10; *&* H E, *ſinus rectus* D E, *peripheriæ dimidiæ per πόρισμα ſeptimæ hujus* 5: *quadratum enim* E F *eſt* 36, *quadratum* C F 64; *horum aggregatum eſt* 100, *& radix ejus* 10, *pro ſubtenſa* C H E: *Itaque* H E *vel* H C *eſt talium* 5.

13. Sinus rectus peripheriæ in circuli quadrante, media proportione eſt ad ſemiradium, & ſinum verſum arcus dupli.

Eſto in diagrammate datus arcus E D, *ad quem duplus ſit* E C: *dico* A G *ſemiradium, eſſe ad* H E *ſinum rectum arcus* D E; *ut* H E *ad* E F, *ſinum verſum arcus dupli* E C. *Triangula enim* A H E, *&* E F C *ſimilia ſunt, ob rectos angulos ad* F *&* H *per ſeptimam hujus, communem ad* E. *Itaque latera eoſdem angulos continentia per quartam ſexti elementorum ſunt proportionalia. Quare ut* A E *latus recto appoſitum, ad latus* C E *recto oppoſitum; ita* E H *latus minus rectum ambiens, ad* E F *latus minus rectum ambiens. Sed ut* A E *ad* C E; *ita* A G *ſemiradius ad* H E *ſemiſſem ſubtenſæ, per decimam quintam quinti elementorum. Ergo ut* A G *ad* H E; *ita* H E *ad* E F, *quod erat demonſtrandum.*

ΠΟΡΙΣΜΑΤΑ *duo.*

Itaque semiradio dato, & cujusvis peripheriæ sinu recto, datur etiam sinus versus peripheriæ duplæ: Nam ut semiradius se habet ad sinum rectum peripheriæ datum; ita sinus rectus peripheriæ datus, ad sinum versum duplæ.

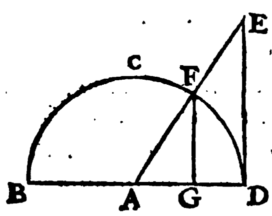


In exemplo, sit A G *semiradius* 5, *&* H E 6; *erit* E F 7 *paulò plus. Nam ut* A G 5 *ad* H E 6; *ita* H E 6 *ad* E F 7 *paulo plus, sinum versum* C E *peripheriæ duplæ hinc verò rectos sinus* A F *&* F C *invenire non est difficile, undecima & octava hujus hoc indicantibus.*

Dato vero semiradio, & sinu cujuscunque peripheriæ verso, invenitur & sinus rectus peripheriæ dimidiæ: factum enim à semiradio per datæ peripheriæ sinum versum, æquatur sinui recto peripheriæ dimidiæ.

In eodem exemplo, detur A G *semiradius* 5; *&* F E *sinus versus peripheriæ* C E 7: *erit* H E *sinus rectus peripheriæ dimidiæ 6 ferè. Nam ut* A G 5 *ad* H E: *ita* H E *est ad* F E 7. *Factus verò ab* A G 5, *per* F E 7, *scilicet* 35, *est æqualis facto per se, per vigesimam septimi Euclidis. Quare hujus radix quadrata 6 fere,* H E *sinui recto peripheriæ dimidiæ competit.*

De quantitate rectarum extra circuli peripheriam.



14. Extra circuli peripheriam consideratur recta peripheriam tangens.

Talis est recta D E, *tangit enim peripheriam* F D.

15. Tangens peripheriæ est recta linea, extremo diametri perpendicularis, in radium per arcus terminum continuatum; ipsi arcui & reliquo ad semicirculum competens.

Ita in præmissa figura, tangens D E *est perpendicularis extremo diametri* B A D, *in radium* A F *continuatum per arcus terminum* F: *competens arcui* F D, *& reliquo ad semicirculum* B C F.

16. Tangens peripheriæ se habet ad radium; ut peripheriæ sinus rectus ad sinum rectum complementi.

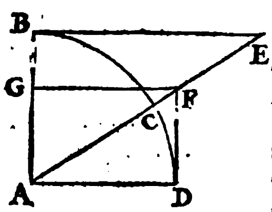
Esto in præcedenti figura recta E D, *tangens peripheriæ* F D; *& ejusdem rectus sinus* F G, *complementi* A G: *radius* A D. *Dico rationem* E D *ad* A D *esse, ut* F G *ad* A G. *Triangula enim* A F G, *&* A E D, *sunt æquiangula, ob rectos angulos ad* D *&* G, *communem ad* A. *Itaque per quartam sexti elementorum latera habent proportionalia.*

ΠΟΡΙΣΜΑ.

Quare sinu recto peripheriæ cujusvis, & complementi cognito, ejusdem tangens non latebit. Nam ut rectus sinus complementi peripheriæ se habet ad sinum rectum ipsius peripheriæ: ita radius ad tangentem ejusdem.

In exemplo, sit A G 6, F G 8, *&* A D 10; *erit* E D 13 *paulo plus. Nam ut* 6 *ad* 8; *ita* 10 *ad* 13 *paulo plus.*

17. Radius media proportione est ad tangentes petipheriæ, & complementi.

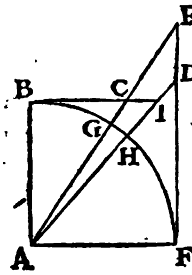


Esto recta F D, *tangens peripheriæ* D C; *complementi verò* B C, *tangens* E B: *radius* A B, *vel* A D. *Dico* A B, *vel* A D *radium, media proportione esse ad* D F *&* B E, *tangentes peripheriarum* D C *&* B C. *Triangula enim* A D F *(vel* A G F *per trigesimam quartam primi elementorum) &* A B E *sunt æquiangula, ob rectos angulos ad* B *&* D *(vel* G*) communem ad* A. *Itaque per quartam Sexti elementorum, ut* G A, *tangens peripheriæ* C D, *ad* G F *radium: ita* A B *radius, ad* B E *tangentem complementi* B C.

ΠΟΡΙΣΜΑ.

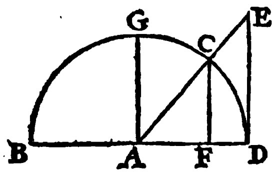
Quare tangentes arcuum complementorum suorum tangentibus reciprocè proportionales sunt.

Sint



Sint enim in adjuncto schemate arcuum F H *&* F G, *tangentes* F D *&* F E; *& complementorum* B G *&* B H, *tangentes* B C *&* B I. *Dico rationem* F D *ad* F E *esse, ut* B C *ad* B I. *Nam per vigesimam octavi Euclidis, Similes plani sunt, inter quos unus proportionalis medius intercidit. Sed inter* F D *&* B I, *item* F E *&* B C, *unus proportionalis medius intercidit, nempe radius: similes ergo plani sunt. Sed per penultimam definitionem septimi Euclidis similes plani latera habent proportionalia: Quare, ut* F D *ad* FE, *ita* BC *ad* B I; *quod erat demonstrandum.*

De magnitudine rectarum per circuli peripheriam.



18. Per circuli peripheriam consideratur recta peripheriã secans.

Talis est recta A E; *secat enim peripheriam* D C B *in* C.

19. Secans peripheriæ, est recta linea per peripheriæ terminum, in tangentem ducta; peripheriæ sectæ & reliquæ ad semicirculum competens.

Ita in præmissa diagrapha, secans A E *ducta est per terminum peripheriæ* D C *in tangentem* E D: *competitque peripheriæ* C D, *& reliquæ ad semicirculum* B C.

20. Radius media proportione est ad peripheriȩ sinum rectũ, & secantem complementi.

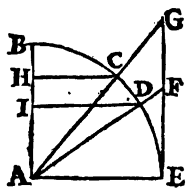
Esto in figura superiori A F, *sinus rectus peripheriæ* G C; *&* A E *secans peripheriæ* C D *(complementi prioris ad circuli quadrantem) dico* A F *sinum peripheriæ* G C *esse ad* A C *radium, ut* A D *radius ad* A E *secantem complementi. Triangula enim* A F C, *&* A D E, *sunt æquiangula; ob rectos angulos ad* F *&* D, *communem ad* A. *Itaque per quartam sexti elementorum, ut* A F *ad* A C; *ita* A D *ad* A E: *quod erat demonstrandum.*

Π Ο Ρ Ι Σ Μ Α Τ Α *duo.*

Itaque ex sinu recto cujusvis peripheriæ, etiam complementi secans datur: ut enim peripheriæ datæ sinus rectus se habet ad radium; ita radius ad secantem complementi.

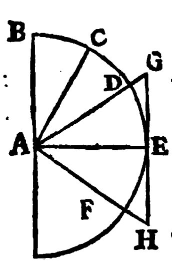
In exemplo sit A F 5, *&* A D 10: *erit* A E 20. *Nam ut* 5 *ad* 10; *ita* 10 *ad* 20, *secantem* A E.

Et secantes arcuum complementorum rectis sinibus reciprocè proportionales sunt.



Sint enim in adjunctâ diagraphâ, arcuum E D *&* E C, *secantes* A F *&* A G; *complementorum verò sinus* A I *&* A H: *Dico* A F *esse ad* A G; *ut* A I *ad* A H. *Nam per* 20 *octavi Euclidis: Similes plani sunt inter quos unus proportionalis medius intercidit. Sed inter secantes peripheriæ, & complementorum sinus, radius est medius proportionalis: quare* A F, A I, *item* A G, A H, *similes plani sunt. Sed per penultimam definitionem septimi Euclidis, Similes plani latera habent proportionalia: Ergo, ut* A F *ad* A G; *ita* A I *ad* A H; *quod erat demonstrandum.*

21. Secans arcus æqualis est Tangenti dati, & semissis complementi.



Esto arcus D E, *secans* A G, *tangens* G E: *Complementi verò arcus* B D, *semissis* B C *(vel æqualis ei* E F*) tangens* E H. *Dico secantem* A G, *æqualem esse* E G *tangenti arcus dati, &* E H *semissi complementi. Angulus enim* G A H, *est æqualis angulo* C A E *ex thesi; angulus verò* E A H *est æqualis angulo* B A C. *Itaque angulus* E H A, *vel* G H A, *est prioris complementum, per trigesimam secundam primi elementorum: & proinde æqualis angulo* C A E. *Quare cùm in Triangulo* G A H, *anguli ad* A *&* H *æquentur; manifestum est latera* G A *&* G H *per sextam primi elementorum etiam æquari: quod erat demonstrandum.*

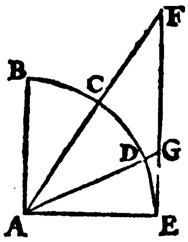
Π Ο Ρ Ι Σ Μ Α.

Quare arcus tangente, & complementi semissis simul additis, componitur dati arcus secans.

Adjiciatur enim E G. *tangens arcus* E D, *ad* E F *complementi semissis tangentem* E H; *componetur* H G, *& æqualis ei* A G *secans peripheriæ* D E.

 22. Se-

22. Secans arcus, circuli quadrantis semisse minoris, cum tangente ejusdem, æqualis est tangenti peripheriæ datæ & semissis complementi.



Esto peripheria D E, *secans* A G; *tangens* E G: *complementi* B D, *semissis* D C; *tangens verò arcus* C D E, *recta* E G F. *Dico rectam* A G, *cum recta* G E, *æquari rectæ* F E. *Angulus enim* A F E, *æqualis est angulo* B A C (*nam ut* B A C *angulus complementum est anguli* F A E: *ita etiam* A F E) *Sed huic æqualis est* F A G *ex thesi: ergo anguli* A F G *&* G A F *per sextam primi elementorum æquantur. Et proinde recta* A G, *æqualis rectæ* F G; *& rectæ* A G, G E *simul, æquales rectæ* F G E: *quod erat demonstrandum.*

ΠΟΡΙΣΜΑ.

Itaque peripheriæ datæ secans, & tangens simul additæ, componunt tangentem peripheriæ, semissis complementi auctæ.

Nam secans A G *& tangens* G E, *æquantur* F E *tangenti peripheriæ* E D, *auctæ semisse complementi* C D. *Quare adjecta* E G *ad* A G, *componitur* F E *tangens peripheriæ* C E.

Atque ita rectarum quæ in circuli peripheria, extra, & per circuli peripheriam considerantur, magnitudo demonstrata est, reliquus est doctrina hujus usus, sequenti libro indicandus.

GEOMETRIÆ TRIANGULORUM LIBER II.

De Canonis Triangulorum Syntaxi.

1. EX superioris doctrinæ fundamentis, Canonem Triangulorum componere non est difficile, certis hypothesibus ad hoc assumptis.

Geometriæ Triangulorum pars secunda nobis posita fuit in Syntaxi Canonis Triangulorum, ea igitur hoc libro demonstranda est.

2. Canon Triangulorum est, qui in assumpta circuli, & dimetientis mensura, omnium circuli quadrantis partium, scrupulorumque primorum, Sinus, Tangentes, & Secantes continet.

Veteres (ut supra dictum) solis subtensis utebantur, & proinde Triangulorum canonem appellabant eum, qui omnium semicirculi partium subtensas continebat. Iam verò cùm præter subtensas & sinus, etiam tangentes, & secantes, circa circulum considerentur, sunt & ea in Canonem Triangulorum referenda.

3. Mensura circuli assumitur partium ccclx, pars lx scrupula prima, unum scrupulum primum lx secunda potest; & ita deinceps.

Hæc circuli divisio est Ptolemæi, & recentiorum Mathematicorum; valde idonea ad numerationem: inter minores enim numeros nullus adeò multiplices partes habet, Vnciam, sextantem, quadrantem, trientem, quincuncem, semissem, septuncem, bessem, dodrantem, dextantem, deuncem, & assem. Retinenda igitur est, & ad eam alia proportionaliter accommodanda sunt.

4. Dimetiens circuli statuitur particularum 20000000.

Ptolemæus diametrum assumit particularum 120: *Arzahel* 300. *Neoterici* 20000000 *particularum eam statuunt: quæ mensura retinenda est; nam cùm plurium particularum sit, plenius diameter secatur, & proinde à multis subdivisionibus logista liberatur.*

5. Qualium dimetiens statuitur particularum 20000000, talium latus sexanguli circulo inscripti est 10000000.

Nam per 15 quarti elementorum latus sexanguli circulo inscripti est æquale radio. Radius autem dia-

diametri semissis est, quare dimidiata diametri mensura 20000000, *datur radius, & æquale ei Sexanguli latus, particularum* 10000000.

6. Trianguli, 17320508 ferè.

Nam per 12 decimitertii Euclidis, Latus Trianguli circulo inscripti potentiâ est triplum radii: Radius autem est particularum, 10000000; *ergo potentia ejus triplicata est particularum* 300000000000000, *& latus ejus* 17320508 *ferè*.

7. Quadranguli 14142136.

Per sextam enim quarti elementorum, Recta quadrantem circuli subtendens, est latus quadranguli circulo inscripti: potest autem ea per penultimam primi elementorum duplum radii. Itaque potentia quadranguli est 200000000000000: *& ejus latus* 14142136.

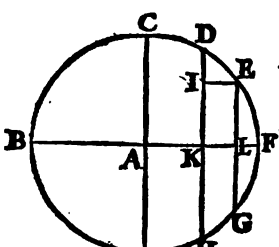
8. Decanguli 6180430.

Nam per nonam decimitertii Euclidis, decanguli latus, est segmentum minus recta linea extrema & media ratione secta, latus sexanguli & decanguli simul mensurantis. Itaque per undecimam secundi elementorum ablato semiradio 5000000, *ex quadrato latere radii & semiradii aggregato* 11180340: *relinquitur decanguli latus* 6180430.

9. Quinquanguli 11755704 ferè.

Nam per decimam decimitertii Euclidis, Latus quinquanguli in circulũ inscripti, potest latus sexanguli & decanguli. Sed sexanguli latus est particularum 10000000, *per quintam hujus: decanguli* 6180430 *per præmissam. Itaque per penultimam primi elementorum Quinquanguli latus est* 11755704 *ferè*.

10. Quindecanguli 4158234 ferè.



Nam per decimamsextam quarti elementorum, recta inscripta inter basim Trianguli & Quinquanguli, ab eodem puncto in circulum ducti est latus Quindecanguli. Atqui talis est D E *in adjuncta figura, inscripta inter basim Trianguli* D H, *& Quinquanguli* E G, *à* B *eodem puncto in circulum ducti: est ergo latus Quindecanguli. Hujus porro magnitudo investigatur hoc modo: datur* D K H *latus Trianguli per 6 hujus* 17320508 *ferè, &* E L G *Quinquanguli latus per præmissum* 11755704 *ferè. Itaque per 7 primi Triangulorum* D K *est* 8660254; E L 5877852, *sinus recti peripheriarum* F D *&* F E: *& differentia eorum* D L 2782402. *Per 8 verò ejusdem* A K *est* 5000000; A L 8090170 *sinus recti complementorum* C D *&* C E: *& differentia eorum* K L *vel* I E 3090170. *Quare cùm in Triangulo* D I E *rectangulo ad* I, *detur latus* D I 2782402, *&* I E 3090170: *per penultimam primi elementorum latus* D E *Quindecanguli est particularum* 4158234 *fere; quod erat demonstrandum*.

11. Si Trianguli, Quadranguli, Quinquanguli, Sexanguli, Decanguli, & tandem ipsius Quindecanguli laterum semisses assumantur, ut angulorum dimidiorum sinus: & ex his complementorum singulorum, semissiumque sinus continuè investigentur; & contra, totus sinuum Canon hac inductione componitur.

Sint inscripta laterum suprà inventa.							*Assumanturque horum semisses, ut Angulorum dimidiorum sinus per septimam primi Triangulorum.*	
Trianguli	120.	17320508	*per*	6	*hujus.*	*Partium*	60	8660254.
Quadranguli	90.	14142196	*per*	7			45	7071068.
Quinquanguli	72.	11755704	*per*	9			36	5877852.
Sexanguli,	60.	10000000	*per*	5			30	5000000.
Decanguli, &	36.	6180340	*per*	8			18	3090170.
Quindecanguli	24.	4158234	*per*	10			12	2079117.

Dico ex harum peripheriarum sinibus datis, reliquarum quadrantis peripheriarum sinus datum iri: Si continuè harum complementorum, semissiumque sinus determinentur, & contrà. Elementum veritatis

tatis ſuæ cauſam aliam non deſiderat, quàm inductionem ab experientiâ factam, quæ in hoc genere ſufficit, cùm numeri ſenſibus ſubjecti ſint. Aſſumatur igitur exempli gratiâ arcus partium 12, *ejuſque ſinus* 2079117; *adhibeatúrque præſentis elementi methodus, hinc ſequentium peripheriarum ſinus dabuntur.*

Continuæ ſemiſſes ex periph. partium 12 deductæ.	& earum ſinus per 12 vel 13 primi hujus.
6	1045285.
3	523360.
1 30	261769.
0 45	130896.
harumque complementa.	*& ſinus per 8 primi hujus.*
84	9945219.
87	9986295.
88 30	9996573.
89 15	9999143.
& horum ſemiſſes,	*& ſinus per 12 vel 13 primi hujus.*
42	6691306.
21	3583679.
10 30	1822355.
5 15	915016.
43 30	6883546.
21 45	3705574.
44 15	6977905.
harúmque complementa,	*& ſinus per 8 primi hujus.*
48	7431448.
69	9339804.
79 30	9832549.
84 45	9958049.
46 30	7253744.
68 15	9288096.
45 45	7160319.
rurſuſque horum ſemiſſes,	*& ſinus per 12 vel 13 primi hujus.*
24	4067366.
34 30	5664062.
17 15	2965416.
39 45	6394390.
23 15	3947439.

& complementa,	*& ſinus per 8 primi hujus.*
66	9135455.
55 30	8241262.
72 45	9550199.
50 15	7688418.
66 45	9187912.
iterumque ſemiſſes horum,	*& ſinus per 12 vel 13 primi hujus.*
33	5446390.
16 30	2840153.
8 15	1434926.
27 45	4656145.
& complementa,	*& ſinus per 8 primi hujus.*
57	8386706.
73 30	9588197.
81 45	9896514.
62 15	8849876.
horúmque ſemiſſes,	*& ſinus per 12 vel 13 primi hujus.*
28 30	4771588.
14 15	2461533.
36 45	5983246.
& complementa,	*& ſinus per 8 primi hujus.*
61 30	8788111.
75 45	9692309.
53 15	8012538.
& ſemiſſis peripheriæ 61, 30,	*& ſinus ejus per 12 vel 13 primi hujus.*
30 45	5112931.
hujúſque complementum,	*& ſinus per 8 primi hujus.*
59 15	8594064.

His verò ſinibus inventis aſſumendum quoque eſt complementum arcus partium 12, *nempe* 78; *& inde ſimili inductione ſemiſsium peripheriarum, complementorúm que ſinus continuè inveſtigandi ſunt. Qua ratio ſi non modò in hujus peripheria ſinu, ſed & reliquis ſupra inventis ſervetur, tandem maxima pars Canonis abſolvetur.*

Cæterum cùm ad Canonem complendum etiam prioris ſcrupuli & ſequentium aliquot ſinus deſiderentur, ſupereſt ut quomodo ex hujus Theorematis methodo, & ii inveſtigandi ſint, paucis oſtendamus. Aſſumatur igitur ſinus partium 0, 45′. *ſupra inventus* 130896: *adhibitáq; inductione ſuperiori hujus ſemiſſes continuè inveſtigentur per* 12 *vel* 13 *primi Triangul. Ita ſequentium peripheriarum ſinus invenientur.*

22′	30′	65449
11	15	32724½

Porro cùm ex his ſinibus appareat eó uſque perveniſſe nos, ubi recta & curva differentia ſenſum prorſus evadit, tanquam una linea factarum, nullus error committetur, ſi æqua ratione reliquis peripheriis 22′ 30′ *minoribus ſinus rectus ejus* 65449 *accommodetur. Ita enim ſinus ſcrupuli unius dabitur* 2909 *ferè, & ſcrupulorum* 15′, 43632; *& ita deinceps. Ex his verò ſinibus ſinuum Canon perficietur. Si duplorum arcuum & complementorum ſinus per decimam tertiam primi Triangulorum inveſtigentur: &*

ex

ex iis rursus semissium complementorúmque continuè; dum totus sinuum Canon absolutus fuerit.

Hæc est sinuum Canonis condendi ratio, quæ cùm ex superioris libri elementis deducta sit, ampliori demonstratione non est opus.

12. Ductis vero singulis totius quadrantis sinibus in radium, planisq; sigillatim in sinus complementorum divisis, dantur singulæ totius circuli quadrantis peripheriarum tangentes, totusque tangentium Canon hac methodo completur.

Hujus elementi ratio ex decimasexta primi hujus manifesta est. Nam per eandem Tangens peripheriæ se habet ad radium; ut peripheriæ sinus rectus ad sinum complementi. Itaque cùm sinuum Canon ex superiori doctrina compositus sit, componetur etiam tangentium Canon: multiplicatis singulis totius quadrantis sinibus in radium, planisque horum sigillatim in complementorum suorum sinus divisis. Exempli gratia, datur sinus partium 30, 5000000, & complementi sui 8660254: ergo tangens partium 30 erit 5773502. Nam ut 8660254 ad 5000000; ita 10000000 se habet ad 5773502.

13. Secantium Canon componitur, radii quadrato in singulos totius circuli quadrantis sinus diviso, initio à sinuum Canonis fine facto.

Nam per vigesimam primi hujus, Radius media proportione est ad peripheriæ sinum rectum, & secantem complementi. Itaque assumptis singulis totius quadrantis sinibus à fine Canonis, divisisque iis in radii quadratum; dantur totius quadrantis secantes: & proinde earum Canon hac viâ completur. In exemplo superiori, datur partium 30 sinus rectus 5000000, & quadratum radii 100000000000000: ergo secans partium 60 assumptæ scilicet peripheriæ complementi est 20000000. Nam ut 5000000 ad 10000000; ita 10000000 ad 20000000.

Atque hæc quidem methodus est Constructionis Canonis Sinuum, Tangentium & Secantium, in quâ tamen spontè à nobis omissa sunt compendia superioris libri Theorematibus 9, 21 & 22 demonstrata. Nam cùm integer Triangulorum Canon ad manum esset, Sinuum quidem à præstantissimo Mathematico Ioanne Regiomontano, Tangentium ab Erasmo Reinholdo, Secantium verò ab Ioachimo Rhetico compositus, latius ista persequi supervacuum duximus. Sufficit enim demonstrasse ex quibus fundamentis Canonis Triangul. constructio deducta, & quæ methodo à præstantissimis artificibus completus sit. Reliquus est Canonis usus quem sequenti theoremate proponimus.

14. Canon Triangulorum in fronte partes circuli quadrantis, in sinistro margine, partium scrupula prima, in communi intersectione, partis scrupulique sinus, tangentes vel secantes, cum differentia 60 scrupulis secundis competente complectitur.

Canonis frons, vulgo tabulæ caput, suprema pars, aut transversalis margo appellatur: continetque totius circuli quadrantis partes. Sinister margo est in quo partium scrupula prima descripta sunt. Communis intersectio, vel angulus est, in quo descendens & transversalis ordo se mutuò intersecant. Differentia verò 60 secundis scrup. competens, est excessus minoris sinus, tangentis vel secantis, super proximè majorem.

ΠΟΡΙΣΜΑΤΑ *duo.*

Itaque assumptæ partis, & primi scrupuli sinus, tangens, vel secans in Canone est, quæ in angulo communi partis assumptæ, & scrupuli primi continetur: & contra.

In exemplo, sinus partium 23 & scrupulorum primorum 28 est 3982155: Talis enim in angulo communi sinuum canonis exhibetur. Viceversa 3982155 sinus est partium 2328: Inventus enim sinus in Canone, partes 23 in fronte, scrupula verò prima 28 ostendit.

Parti vero & scrupulis primis, etiam secundis adhærentibus pars proportionalis differentiæ (quæ L X scrupulis secundis competit) sinui, tangenti, vel secanti proximè minori addita, assumptæ peripheriæ sinum, tangentem, vel secantem componit; & contra.

Exempli gratiâ, sinus partium 23, scrup. pr. 28, scrup. sec. 30, est 3983489. Nam proximè minor sinus in Canone invenitur, 3982155; & differentia scrupulis 60 secundis competens est 2668: ergo proportionalis pars 30 secundis tribuenda est 1334 (Nam per auream regulam, ut 60 ad 2668; ita 30 ad 1334) hæc autem sinui minori 3982155 adjecta componit 3983489, sinum peripheriæ 23-28-30 quæsitum. Viceversa peripheriæ sinus 3983489, ex sinuum Canone invenitur partium 23-28-30. Nam sinus proximè minor 3982155, competit arcui partium 23-28. Differentia verò hujus sinus & præcedentis dati est 1334: cui congruum 30 scrupula secunda, (Nam ut 2668 differentia sexaginta scrupulis secundis competens, ad scrupula 60 secunda: ita 1334 ad 30 scrupula secunda) Itaque bis ad arcum 23-28 proximè minorem adjectis, componitur peripheria partium 23-28-30, sinui proposito 3983489, correspondens. Et hic quidem Canonis usus. Iam ipsum Canonem subjicimus.

0	Sinus		Tangens		Secans		
0	0	100000.00	0	Infinitum.	100000.00	Infinitum.	60
1	29.09	99999.99	29.09	343774667.38	100000.00	343774681.93	59
2	58.18	99999.98	58.18	171887319.15	100000.02	171887348.24	58
3	87.27	99999.96	87.27	114591529.94	100000.04	114591573.57	57
4	116.36	99999.93	116.36	85943630.48	100000.07	85943688.66	56
5	145.44	99999.89	145.44	68754886.93	100000.11	68754959.66	55
6	174.53	99999.84	174.53	57295721.34	100000.16	57295808.60	54
7	203.62	99999.79	203.62	49110600.28	100000.21	49110702.09	53
8	232.71	99999.73	232.71	42971757.06	100000.27	42971873.42	52
9	261.80	99999.66	261.80	38197099.08	100000.34	38197229.98	51
10	290.89	99999.58	290.89	34377370.74	100000.42	34377516.19	50
11	319.98	99999.49	319.98	31252136.71	100000.51	31252206.70	49
12	349.06	99999.39	349.07	28647773.40	100000.61	28647947.93	48
13	378.15	99999.28	378.16	26444079.88	100000.72	26444268.95	47
14	407.24	99999.17	407.25	24555198.33	100000.83	24555401.95	46
15	436.33	99999.05	436.33	22918166.36	100000.95	22918384.53	45
16	465.42	99998.92	465.42	21485762.18	100001.08	21485994.89	44
17	494.51	99998.78	494.51	20221874.99	100001.22	20222122.25	43
18	523.60	99998.63	523.60	19098418.64	100001.37	19098680.44	42
19	552.68	99998.47	552.69	18093219.83	100001.53	18093496.17	41
20	581.77	99998.30	581.78	17188539.93	100001.70	17188830.82	40
21	610.86	99998.13	610.87	16370019.10	100001.87	16370324.53	39
22	639.95	99997.95	639.96	15625908.37	100002.05	15626228.34	38
23	669.04	99997.76	669.05	14946502.08	100002.24	14946836.60	37
24	698.13	99997.56	698.14	14323712.17	100002.44	14324061.23	36
25	727.21	99997.35	727.23	13750744.68	100002.65	13751108.29	35
26	756.30	99997.13	756.32	13221850.86	100002.86	13222229.02	34
27	785.39	99996.91	785.41	12732133.65	100003.08	12732526.35	33
28	814.48	99996.68	814.50	12277395.54	100003.31	12277802.79	32
29	843.57	99996.44	843.60	11854018.02	100003.55	11854439.81	31
30	872.65	99996.19	872.69	11458865.01	100003.80	11459301.35	30
31	901.74	99995.93	901.78	11089205.13	100004.06	11089656.01	29
32	930.83	99995.66	930.87	10742648.38	100004.33	10743113.80	28
33	959.92	99995.39	959.96	10417094.48	100004.61	10417574.45	27
34	989.00	99995.11	989.05	10110690.24	100004.89	10111184.75	26
35	1018.09	99994.82	1018.14	9821794.26	100005.18	9822303.32	25
36	1047.18	99994.52	1047.24	9548947.52	100005.48	9549471.12	24
37	1076.27	99994.21	1076.33	9290848.72	100005.79	9291386.87	23
38	1105.35	99993.89	1105.42	9046333.57	100006.11	9046886.26	22
39	1134.44	99993.56	1134.51	8814357.15	100006.44	8814924.39	21
40	1163.53	99993.23	1163.61	8593979.07	100006.77	8594560.86	20
41	1192.61	99992.89	1192.70	8384350.67	100007.11	8384947.00	19
42	1221.70	99992.54	1221.79	8184704.11	100007.46	8185314.98	18
43	1250.79	99992.18	1250.88	7994342.99	100007.82	7994968.41	17
44	1279.87	99991.81	1279.98	7812634.20	100008.19	7813274.16	16
45	1308.96	99991.43	1309.07	7639000.93	100008.57	7639655.44	15
46	1338.05	99991.04	1338.17	7472916.51	100008.96	7473585.56	14
47	1367.13	99990.65	1367.26	7313899.10	100009.35	7314582.70	13
48	1396.22	99990.25	1396.35	7161507.01	100009.75	7162205.15	12
49	1425.30	99989.84	1425.45	7015334.61	100010.16	7016047.35	11
50	1454.39	99989.42	1454.54	6875008.72	100010.58	6875735.95	10
51	1483.48	99988.99	1483.64	6740185.43	100011.01	6740927.20	9
52	1512.56	99988.55	1512.73	6610547.27	100011.45	6611303.59	8
53	1541.65	99988.11	1541.83	6485800.75	100011.89	6486571.62	7
54	1570.73	99987.66	1570.93	6365674.12	100012.34	6366459.53	6
55	1599.82	99987.20	1600.02	6249915.37	100012.80	6250715.33	5
56	1618.90	99986.73	1629.12	6138290.52	100013.27	6139105.02	4
57	1617.99	99986.25	1658.21	6030581.99	100013.75	6031411.04	3
58	1687.07	99985.76	1687.31	5926587.21	100014.24	5927430.81	2
59	1716.16	99985.27	1716.41	5826117.35	100014.73	5826975.49	1
60	1745.24	99984.77	1745.51	5728996.16	100015.23	5729868.85	0

1	Sinus		Tangens		Secans		
0	1745.24	99984.77	1745.51	5728996.16	100015.23	5729868.85	60
1	1774.32	99984.26	1774.60	5635058.96	100015.74	5635946.19	59
2	1803.41	99983.74	1803.70	5544151.67	100016.26	5545053.45	58
3	1832.49	99983.21	1832.80	5456130.03	100016.79	5457046.35	57
4	1861.58	99982.67	1861.90	5370858.75	100017.33	5371789.62	56
5	1890.66	99982.12	1891.00	5288210.91	100017.88	5289156.37	55
6	1919.74	99981.57	1920.10	5208067.26	100018.43	5209027.22	54
7	1948.83	99981.01	1949.20	5130315.66	100018.99	5131290.17	53
8	1977.91	99980.44	1978.30	5054850.59	100019.56	5055839.65	52
9	2006.99	99979.86	2007.40	4981572.64	100020.14	4982576.23	51
10	2036.08	99979.27	2036.50	4910388.06	100020.73	4911406.20	50
11	2065.16	99978.67	2065.60	4841208.41	100021.33	4842241.10	49
12	2094.24	99978.06	2094.70	4773950.14	100021.94	4774997.38	48
13	2123.32	99977.45	2123.80	4708534.30	100022.55	4709596.08	47
14	2152.41	99976.83	2152.91	4644886.20	100023.17	4645962.53	46
15	2181.49	99976.20	2182.01	4582935.12	100023.80	4584025.99	45
16	2210.57	99975.56	2211.11	4522614.07	100024.44	4523719.49	44
17	2239.65	99974.91	2240.21	4463859.56	100025.09	4464979.52	43
18	2268.73	99974.25	2269.32	4406611.32	100025.75	4407745.83	42
19	2297.81	99973.59	2298.42	4350812.16	100026.41	4351961.22	41
20	2326.90	99972.92	3327.53	4296407.73	100027.08	4297571.34	40
21	2355.98	99972.24	2356.63	4243346.39	100027.76	4244524.54	39
22	2385.06	99971.55	2385.74	4191576.99	100028.45	4192771.68	38
23	2414.14	99970.85	2414.84	4141058.76	100029.15	4142266.00	37
24	2443.22	99970.14	2443.95	4091741.16	100029.86	4092961.95	36
25	2472.30	99969.43	2473.05	4043583.75	100030.58	4044810.09	35
26	2501.38	99968.71	2502.16	3996546.05	100031.30	3997796.94	34
27	2530.46	99967.98	2531.27	3950589.46	100032.03	3951854.89	33
28	2559.54	99967.24	2560.38	3905677.11	100032.77	3906957.09	32
29	2588.62	99966.49	2589.48	3861773.81	100033.52	3863068.34	31
30	2617.69	99965.73	2618.59	3818845.93	100034.28	3820155.00	30
31	2646.77	99964.96	2647.70	3776861.30	100035.05	3778184.92	29
32	2675.85	99964.19	2676.81	3735789.17	100035.82	3737127.34	28
33	2704.93	99963.41	2705.92	3695600.11	100036.60	3696952.82	27
34	2734.01	99962.62	2735.03	3656265.92	100037.39	3657633.18	26
35	2763.09	99961.82	2764.14	2617759.62	100038.19	3619141.43	25
36	2792.16	99961.01	2793.25	3580055.33	100039.00	3581451.68	24
37	2821.24	99960.19	2822.36	3543128.25	100039.82	3544539.15	23
38	2850.32	99959.36	2851.48	3506954.58	100040.65	3508380.03	22
39	2879.40	99958.53	2880.59	3471511.50	100041.48	3472951.50	21
40	2908.47	99957.69	2909.70	3436777.09	100042.32	3438231.63	20
41	2937.55	99956.84	2938.82	3402730.29	100043.17	3404199.39	19
42	2966.62	99955.98	2967.93	3369350.89	100044.03	3370834.53	18
43	2995.70	99955.11	2997.05	3336619.45	100044.90	3338117.63	17
44	3024.78	99954.24	3026.16	3304517.27	100045.78	3306030.00	16
45	3053.85	99953.36	3055.28	3273026.37	100046.67	3274553.65	15
46	3082.93	99952.47	3084.39	3242129.46	100047.56	3243671.29	14
47	3112.00	99951.57	3113.51	3211809.88	100048.46	3213366.26	13
48	3141.08	99950.66	3142.63	3182051.60	100049.37	3183622.52	12
49	3170.15	99949.74	3171.74	3152839.16	100050.29	3154424.63	11
50	3199.22	99948.81	3200.86	3124157.67	100051.22	3125757.70	10
51	3228.30	99947.88	3229.98	3095992.80	100052.15	3097607.37	9
52	3257.37	99946.94	3259.10	3068330.70	100053.09	3069959.82	8
53	3286.44	99945.99	3288.22	3041158.02	100054.05	3042801.69	7
54	3315.52	99945.03	3317.34	3014461.89	100055.01	3016120.10	6
55	3344.59	99944.06	3346.46	2988229.86	100055.98	2989902.63	5
56	3373.66	99943.08	3375.58	2962449.95	100056.96	2964137.26	4
57	3402.73	99942.09	3404.71	2937110.55	100057.95	2938812.41	3
58	3431.81	99941.09	3433.83	2912100.47	100058.94	2913916.88	2
59	3460.88	99940.09	3462.95	2887708.88	100059.94	2889439.84	1
60	3489.95	99939.08	3492.08	2863625.33	100060.95	2865370.83	0

2	Sinus		Tangens		Secans		
0	3489.95	99939.08	3492.08	2863625.33	100060.95	2865370.83	60
1	3519.02	99938.06	3521.20	2839939.69	100061.97	2841699.74	59
2	3548.09	99937.03	3550.33	2816642.18	100063.00	2818416.78	58
3	3577.16	99935.99	3579.45	2793723.33	100064.04	2795512.48	57
4	3606.23	99934.95	3608.58	2771173.99	100065.09	2772977.69	56
5	3635.30	99933.90	3637.71	2748985.28	100066.15	2750803.53	55
6	3664.37	99932.84	3666.83	2727148.61	100067.21	2728981.41	54
7	3693.44	99931.77	3695.96	2705655.68	100068.28	2707503.03	53
8	3722.51	99930.69	3725.09	2684498.43	100069.36	2686360.33	52
9	3751.58	99929.60	3754.22	2663669.04	100070.45	2665545.49	51
10	3780.65	99928.51	3783.35	2643159.96	100071.55	2645050.96	50
11	3809.71	99927.40	3812.48	2622963.84	100072.66	2624869.39	49
12	3838.78	99926.29	3841.61	2603073.58	100073.77	2604993.68	48
13	3867.85	99925.17	3870.74	2583482.27	100074.89	2585416.92	47
14	3896.91	99924.04	3899.88	2564183.23	100076.02	2566132.43	46
15	3925.98	99922.90	3929.01	2545169.96	100077.16	2547133.71	45
16	3955.05	99921.75	3958.14	2526436.15	100078.31	2528414.45	44
17	3984.11	99920.60	3987.28	2507975.68	100079.47	2509968.53	43
18	4013.18	99919.44	4016.41	2489782.62	100080.63	2491790.02	42
19	4042.24	99918.27	4045.55	2471851.19	100081.80	2473873.14	41
20	4071.31	99917.09	4074.69	2454175.78	100082.98	2456212.28	40
21	4100.37	99915.90	4103.83	2436750.95	100084.17	2438802.00	39
22	4129.44	99914.70	4132.96	2419571.40	100085.37	2421637.00	38
23	4158.50	99913.49	4162.10	2402631.99	100086.58	2404712.14	37
24	4187.57	99912.28	4191.24	2385927.72	100087.80	2388022.42	36
25	4216.63	99911.06	4220.38	2369453.72	100089.02	2371562.97	35
26	4245.69	99909.83	4249.52	2353205.25	100090.25	2355329.05	34
27	4274.75	99908.59	4278.66	2337177.72	100091.49	2339316.07	33
28	4303.82	99907.34	4307.81	2321366.65	100092.74	2323519.55	32
29	4332.88	99906.08	4336.95	2305767.67	100094.00	2307935.13	31
30	4361.94	99904.82	4366.09	2290376.55	100095.27	2292558.56	30
31	4391.00	99903.55	4395.24	2275189.16	100096.55	2277385.72	29
32	4420.06	99902.27	4424.38	2260201.48	100097.83	2262412.59	28
33	4449.12	99900.98	4453.53	2245409.59	100099.12	2247635.25	27
34	4478.18	99899.68	4482.68	2230809.67	100100.42	2233049.89	26
35	4507.24	99898.37	4511.82	2216398.02	100101.73	2218652.78	25
36	4536.30	99897.05	4540.97	2202171.00	100103.05	2204440.52	24
37	4565.36	99895.73	4570.12	2188125.10	100104.38	2190408.97	23
38	4594.42	99894.40	4599.27	2174256.87	100105.71	2176555.29	22
39	4623.47	99893.06	4628.42	2160562.96	100107.05	2162875.93	21
40	4652.53	99891.71	4657.57	2147040.10	100108.40	2149367.63	20
41	4681.59	99890.35	4686.73	2133685.11	100109.76	2136027.19	19
42	4710.64	99888.98	4715.88	2120494.88	100111.13	2122851.51	18
43	4739.70	99887.61	4745.03	2107466.37	100112.51	2109837.55	17
44	4768.76	99886.23	4774.19	2094196.63	100113.90	2096982.36	16
45	4797.81	99884.84	4803.34	2081882.76	100115.30	2084283.05	15
46	4826.87	99883.44	4832.50	2069321.96	100116.70	2071736.80	14
47	4855.92	99882.03	4861.66	2056911.47	100118.11	2059340.86	13
48	4884.98	99880.61	4890.82	2044648.61	100191.53	2047092.55	12
49	4914.03	99879.18	4919.97	2032530.75	100120.96	2034989.25	11
50	4943.08	99877.75	4949.13	2020555.35	100122.40	2023028.40	10
51	4972.14	99876.31	4978.29	2008719.89	100123.85	2011207.50	9
52	5001.19	99874.86	5007.46	1997021.95	100125.30	1999524.11	8
53	5030.24	99873.40	5036.62	1985459.12	100126.76	1987975.84	7
54	5059.29	99871.93	5065.78	1974029.10	100128.23	1976560.36	6
55	5088.35	99870.45	5094.95	1962729.59	100129.71	1965275.41	5
56	5117.40	99868.97	5124.11	1951558.37	100131.20	1954118.74	4
57	5146.45	99867.48	5153.28	1940513.27	100132.70	1943088.20	3
58	5175.50	99865.98	5182.44	1929592.17	100134.20	1932181.65	2
59	5204.55	99864.47	5211.61	1918792.98	100135.71	1921397.01	1
60	5233.60	99862.95	5240.78	1908113.67	100137.23	1910732.26	0

3	Sinus		Tangens		Secans		
0	5233.60	99862.95	5240.78	1908113.67	100137.23	1910732.26	60
1	5262.64	99861.42	5269.95	1897552.26	100138.76	1900185.40	59
2	5291.69	99859.89	5299.12	1887106.80	100140.30	1889754.50	58
3	5320.74	99858.35	5328.29	1876775.39	100141.85	1879437.65	57
4	5349.79	99856.80	5357.46	1866556.18	100143.41	1869232.99	56
5	5378.83	99855.24	5386.03	1856347.34	100144.98	1859138.71	55
6	5407.88	99853.67	5415.81	1846447.09	100146.55	1849153.01	54
7	5436.93	99852.09	5444.98	1836553.70	100148.13	1839274.17	53
8	5465.97	99850.50	5474.16	1826765.44	100149.72	1829500.48	52
9	5495.02	99848.91	5503.33	1817080.67	100151.32	1819830.26	51
10	5524.06	99847.31	5532.51	1807497.74	100152.93	1810261.88	50
11	5553.11	99845.70	5501.69	1798015.05	100154.55	1800793.75	49
12	5582.15	99844.08	5590.87	1788631.04	100156.17	1791424.29	48
13	5611.19	99842.45	5620.05	1779344.17	100157.80	1782151.98	47
14	5640.24	99840.81	5649.23	1770152.94	100159.44	1772975.31	46
15	5669.28	99839.16	5678.41	1761055.88	100161.09	1763892.80	45
16	5698.32	99837.51	5707.59	1752051.55	100162.75	1754903.03	44
17	5727.36	99835.85	5736.78	1743138.54	100164.42	1746004.57	43
18	5756.40	99834.18	5765.96	1734315.46	100166.10	1737196.05	42
19	5785.44	99832.50	5795.15	1725580.95	100167.78	1728476.10	41
20	5814.48	99830.81	5824.34	1716933.69	100169.47	1719843.40	40
21	5843.52	99829.11	5853.52	1708372.38	100171.17	1711296.64	39
22	5872.56	99827.41	5882.71	1699895.74	100172.88	1702834.56	38
23	5901.60	99825.70	5911.90	1691502.51	100174.60	1694455.89	37
24	5930.64	99823.98	5941.09	1683191.48	100176.33	1686159.41	36
25	5959.67	99822.25	5970.29	1674961.44	100178.07	1677943.92	35
26	5988.71	99820.51	5999.48	1666811.20	100179.81	1669808.25	34
27	6017.75	99818.76	6028.67	1658739.62	100181.56	1661751.22	33
28	6046.78	99817.01	6057.87	1650745.55	100183.32	1653771.71	32
29	6075.82	99815.25	6087.06	1642827.89	100185.09	1645868.61	31
30	6104.85	99813.48	6116.26	1634985.55	100186.87	1638040.81	30
31	6133.89	99811.70	6145.46	1627217.44	100188.66	1630287.28	29
32	6162.92	99809.91	6174.66	1619522.53	100190.46	1622606.93	28
33	6191.96	99808.11	6203.86	1611899.79	100192.26	1614998.74	27
34	6220.99	99806.30	6233.06	1604348.19	100194.07	1607461.70	26
35	6250.02	99804.49	6261.26	1596866.74	100195.89	1599994.81	25
36	6279.05	99802.67	6291.47	1589454.48	100197.72	1592597.11	24
37	6308.08	99800.84	6320.67	1582110.45	100199.56	1585267.64	23
38	6337.11	99799.00	6349.88	1574833.71	100201.41	1578005.45	22
39	6366.14	99797.15	6379.08	1567623.33	100203.26	1570809.63	21
40	6395.17	99795.29	6408.29	1560478.41	100205.13	1563679.27	20
41	6424.20	99793.43	6437.50	1553198.06	100206.99	1556613.48	19
42	6453.23	99791.56	6466.71	1546381.41	100208.87	1549611.39	18
43	6482.26	99789.68	6495.92	1539427.60	100210.76	1542672.15	17
44	6511.29	99787.79	6525.13	1532535.80	100212.66	1535794.90	16
45	6540.31	99785.89	6554.35	1525705.17	100214.57	1528978.83	15
46	6569.34	99783.98	6583.56	1518934.90	100216.49	1522223.12	14
47	6598.36	99782.06	6612.78	1512224.20	100218.41	1515526.98	13
48	6627.39	99780.14	6641.99	1505572.27	100220.34	1508889.61	12
49	6656.41	99778.21	6671.21	1498978.36	100222.28	1502310.26	11
50	6685.44	99776.27	6700.43	1492441.70	100224.23	1495788.16	10
51	6714.46	99774.32	6729.65	1485961.55	100226.19	1489322.58	9
52	6743.48	99772.36	6758.87	1479537.18	100228.16	1482912.77	8
53	6772.51	99770.39	6788.09	1473167.87	100230.13	1476558.02	7
54	6801.53	99768.42	6817.32	1466852.92	100232.11	1470257.63	6
55	6830.55	99766.44	6846.54	1460591.63	100234.10	1464010.90	5
56	6859.57	99764.45	6875.77	1454383.32	100236.10	1457817.15	4
57	6888.59	99762.45	6904.99	1448227.32	100238.11	1451676.71	3
58	6917.61	99760.44	6934.22	1442122.97	100240.13	1445585.92	2
59	6946.63	99758.42	6963.45	1436069.61	100242.16	1439547.13	1
60	6975.65	99756.40	6992.68	1430066.63	100244.19	1433558.70	0

4	Sinus		Tangens		Secans		
0	6975.65	99756.40	6992.68	1430066.63	100244.19	1433558.70	60
1	7004.66	99754.37	7021.91	1424113.37	100246.23	1427620.01	59
2	7033.68	99752.33	7051.15	1418209.24	100248.28	1421730.45	58
3	7062.70	99750.28	7080.38	1412353.63	100250.34	1415889.39	57
4	7091.71	99748.22	7109.61	1406545.93	100252.41	1410096.25	56
5	7120.73	99745.15	7138.85	1400785.56	100254.49	1404350.45	55
6	7149.74	99744.07	7168.09	1395071.94	100256.58	1398651.39	54
7	7178.76	99741.99	7197.33	1389404.51	100258.68	1392998.52	53
8	7207.77	99739.90	7226.57	1383782.70	100260.78	1387391.28	52
9	7236.78	99737.80	7255.81	1378205.98	100262.89	1381829.12	51
10	7265.80	99735.69	7285.05	1372673.79	100265.01	1376311.49	50
11	7294.81	99733.57	7314.30	1367185.60	100267.14	1370837.87	49
12	7323.82	99731.44	7343.54	1361740.89	100269.28	1365407.72	48
13	7352.83	99729.31	7372.79	1356339.15	100271.43	1360020.54	47
14	7381.84	99727.17	7402.03	1350979.86	100273.58	1354675.82	46
15	7410.85	99725.02	7431.28	1345662.53	100275.74	1349373.06	45
16	7439.86	99722.86	7460.53	1340386.67	100277.91	1344111.76	44
17	7468.87	99720.69	7489.79	1335151.79	100280.09	1338891.44	43
18	7497.87	99718.51	7519.04	1329957.41	100282.28	1333721.63	42
19	7526.88	99716.32	7548.29	1324803.07	100284.48	1328571.86	41
20	7555.89	99714.13	7577.55	1319688.30	100286.68	1323472.65	40
21	7584.89	99711.93	7606.80	1314612.66	100288.89	1318410.57	39
22	7613.90	99709.72	7636.06	1309575.68	100291.11	1313388.16	38
23	7642.90	99707.50	7665.32	1304576.93	100293.34	1308403.98	37
24	7671.90	99705.27	7694.58	1299615.98	100295.58	1303457.60	36
25	7700.91	99703.03	7723.84	1294692.40	100297.83	1298548.58	35
26	7729.91	99700.79	7753.11	1289805.77	100300.09	1293676.51	34
27	7758.91	99698.54	7782.37	1284955.66	100302.36	1288840.97	33
28	7787.91	99696.28	7811.64	1280141.68	100304.64	1284041.55	32
29	7816.91	99694.01	7840.90	1275363.41	100306.93	1279277.86	31
30	7845.91	99691.73	7870.17	1270620.47	100309.22	1274549.48	30
31	7874.91	99689.44	7899.44	1265912.46	100311.52	1269856.04	29
32	7903.91	99687.15	7928.71	1261239.00	100313.83	1265197.25	28
33	7932.90	99684.85	7957.98	1256599.71	100316.15	1260572.42	27
34	7961.90	99682.54	7987.26	1251994.20	100318.48	1255981.48	26
35	7990.90	99680.22	8016.53	1247422.12	100320.81	1251423.97	25
36	8019.89	99677.89	8045.81	1242883.10	100323.15	1246899.52	24
37	8048.89	99675.55	8075.09	1238376.79	100325.50	1242407.77	23
38	8077.88	99673.20	8104.37	1233902.82	100327.86	1237948.37	22
39	8106.87	99670.85	8133.65	1229460.85	100330.23	1233520.97	21
40	8135.87	99668.49	8162.93	1225050.55	100332.61	1229125.23	20
41	8164.86	99666.12	8192.21	1220671.56	100335.00	1224760.82	19
42	8193.85	99663.74	8221.50	1216323.56	100337.40	1220427.39	18
43	8222.84	99661.35	8250.78	1212006.22	100339.80	1216124.62	17
44	8251.83	99658.95	8280.07	1207719.22	100342.21	1211852.18	16
45	8280.82	99656.55	8309.36	1203462.23	100344.63	1107609.76	15
46	8309.81	99654.14	8338.65	1199234.95	100347.06	1203397.05	14
47	8338.80	99651.72	8367.94	1195037.05	100349.50	1199113.72	13
48	8367.78	99649.29	8397.23	1190868.24	100351.95	1195059.48	12
49	8396.77	99646.85	8426.53	1186728.21	100354.41	1190934.02	11
50	8425.76	99644.40	8455.83	1182616.67	100356.87	1186837.05	10
51	8454.74	99641.94	8485.12	1178533.31	100359.34	1182768.27	9
52	8483.73	99639.48	8514.42	1174477.86	100361.82	1178727.39	8
53	8512.71	99637.01	8543.72	1170450.03	100364.81	1174714.12	7
54	8541.69	99634.53	8573.02	1166449.53	100366.81	1170728.19	6
55	8570.67	99632.04	8602.33	1162476.08	100369.32	1166769.32	5
56	8599.66	99629.54	8631.63	1158529.42	100371.84	1162837.23	4
57	8628.64	99627.03	8660.94	1154609.27	100374.36	1158931.65	3
58	8657.62	99624.52	8690.25	1150715.36	100376.89	1155052.31	2
59	8686.60	99622.00	8719.56	1146847.43	100379.43	1151198.96	1
60	8715.57	99619.47	8748.87	1143005.23	100381.98	1147371.32	0

5	Sinus		Tangens		Secans		
0	8715.57	99619.47	8748.87	1143005.23	100381.98	1147371.32	60
1	8744.55	99616.93	8778.18	1139188.49	100384.54	1143569.16	59
2	8773.53	99614.38	8807.49	1135396.96	100387.11	1139792.20	58
3	8802.51	99611.82	8836.81	1131630.40	100389.69	1136040.21	57
4	8831.48	99609.26	8866.12	1127888.55	100392.28	1132312.93	56
5	8860.46	99606.69	8895.44	1124171.17	100394.87	1128610.13	55
6	8889.43	99604.11	8924.76	1120478.03	100397.47	1124931.56	54
7	8918.40	99601.52	8954.08	1116808.88	100400.08	1121276.99	53
8	8947.34	99598.92	8983.41	1113163.50	100402.70	1117645.17	52
9	8976.35	99596.31	9012.73	1109541.64	100405.33	1114038.90	51
10	9005.32	99593.69	9042.06	1105943.10	100407.97	1110454.92	50
11	9034.29	99591.07	9071.38	1102367.63	100410.61	1106894.03	49
12	9063.26	99588.44	9100.71	1098815.01	100413.26	1103355.99	48
13	9092.23	99585.80	9130.04	1095285.04	100415.92	1099840.59	47
14	9121.19	99583.15	9159.38	1091777.49	100418.59	1096347.61	46
15	9150.16	99580.49	9188.71	1088292.14	100421.27	1092876.84	45
16	9179.13	99577.82	9218.04	1084828.80	100423.96	1089428.07	44
17	9208.09	99575.15	9247.38	1081387.24	100426.66	1086001.09	43
18	9237.06	99572.47	9276.72	1077967.27	100429.37	1082595.69	42
19	9266.02	99569.78	9306.05	1074568.68	100432.08	1079211.68	41
20	9294.99	99567.08	9335.40	1071191.26	100434.80	1075848.84	40
21	9323.95	99564.37	9364.74	1067834.84	100437.53	1072506.99	39
22	9352.91	99561.65	9394.09	1064499.19	100440.27	1069285.92	38
23	9381.87	99558.92	9423.44	1061184.14	100443.02	1065885.45	37
24	9410.83	99556.19	9452.78	1057889.50	100445.78	1062605.38	36
25	9439.79	99553.45	9482.13	1054615.07	100448.55	1059345.53	35
26	9468.75	99550.70	9511.48	1051360.67	100451.33	1056105.70	34
27	9497.71	99547.94	9540.84	1048126.11	100454.11	1052885.72	33
28	9526.66	99545.17	9570.19	1044911.22	100456.90	1049685.41	32
29	9555.62	99542.40	9599.55	1041715.81	100459.70	1046504.58	31
30	9584.58	99539.62	9628.90	1038539.71	100462.51	1043343.05	30
31	9613.53	99536.83	9658.26	1035382.74	100465.33	1040200.66	29
32	9642.48	99534.03	9687.63	1032244.73	100468.16	1037077.23	28
33	9671.44	99531.22	9716.99	1029125.51	100470.99	1033972.59	27
34	9700.39	99528.40	9746.35	1026024.90	100473.83	1030886.56	26
35	9729.34	99525.57	9775.72	1022942.76	100476.68	1027818.99	25
36	9758.29	99522.74	9805.09	1019878.90	100479.54	1024769.71	24
37	9787.24	99519.90	9834.46	1016833.16	100482.41	1021738.55	23
38	9816.19	99517.05	9863.83	1013805.39	100485.29	1018725.36	22
39	9845.14	99514.19	9893.20	1010795.42	100488.18	1015729.98	21
40	9874.08	99511.32	9922.57	1007803.11	100491.08	1012752.24	20
41	9903.03	99508.44	9951.95	1004828.28	100493.99	1009792.00	19
42	9931.97	99505.55	9981.33	1001870.80	100496.90	1006849.09	18
43	9960.92	99502.66	10010.71	998930.50	100499.82	1003923.38	17
44	9989.86	99499.76	10040.09	996007.24	100502.75	1001014.70	16
45	10018.81	99496.85	10069.47	993100.88	100505.69	998122.91	15
46	10047.75	99493.93	10098.85	990211.25	100508.64	995247.87	14
47	10076.69	99491.00	10128.24	987338.23	100511.60	992389.43	13
48	10105.63	99488.06	10157.63	984481.66	100514.57	989547.44	12
49	10134.57	99485.12	10187.02	981641.40	100517.54	986721.76	11
50	10163.51	99482.17	10216.41	978817.32	100520.52	983912.27	10
51	10192.45	99479.21	10245.80	976009.27	100523.51	981118.80	9
52	10221.38	99476.24	10275.20	973217.13	100526.51	978341.24	8
53	10250.32	99473.26	10304.60	970440.75	100529.52	975579.44	7
54	10279.25	99470.27	10334.00	967680.00	100532.54	972833.27	6
55	10308.19	99467.28	10363.40	964934.75	100535.57	970101.60	5
56	10337.12	99464.28	10392.80	962204.86	100538.60	967387.30	4
57	10366.05	99461.27	10422.20	959490.22	100541.64	964687.24	3
58	10394.99	99458.25	10451.60	956790.68	100544.69	962002.29	2
59	10423.92	99455.22	10481.01	954106.13	100547.75	959332.33	1
60	10452.85	99452.18	10510.42	951436.45	100550.82	956677.22	0

6	Sinus		Tangens		Secans		
0	10452.85	99452.18	10510.42	951436.45	100550.82	956677.22	60
1	10481.78	99449.14	10539.83	948781.49	100553.90	954036.86	59
2	10510.70	99446.09	10569.24	9,6141.16	100556.99	951411.20	58
3	10539.63	99443.03	10598.66	943515.31	100560.09	948799.84	57
4	10568.56	99439.96	10628.08	940903.84	100563.20	946202.96	56
5	10597.48	99436.88	10657.50	938306.63	100566.31	943620.33	55
6	10626.41	99433.79	10686.92	935723.55	100569.43	941051.84	54
7	10655.33	99430.69	10716.34	933154.50	100572.56	938497.38	53
8	10684.25	99427.59	10745.70	930599.36	100575.70	935956.82	52
9	10713.18	99424.48	10775.19	928058.02	100578.85	933430.06	51
10	10742.10	99421.36	10804.62	925530.35	100582.01	930916.99	50
11	10771.02	99418.23	10834.05	923016.27	100585.18	928417.49	49
12	10799.94	99415.09	10863.48	920515.64	100588.35	925931.45	48
13	10828.85	99411.94	10892.91	918028.38	100591.53	923458.77	47
14	10857.77	99408.79	10922.34	915554.36	100594.72	920999.34	46
15	10886.69	99405.63	10951.78	913093.48	100597.92	918553.05	45
16	10915.60	99402.46	10981.22	910645.64	100601.13	916119.80	44
17	10944.52	99399.28	11010.66	908210.74	100604.35	913699.49	43
18	10973.43	99396.09	11040.10	905788.67	100607.58	911292.00	42
19	11002.34	99392.89	11069.54	903379.33	100610.81	908897.25	41
20	11031.26	99389.69	11098.99	900982.61	100614.05	906515.12	40
21	11060.17	99386.48	11128.44	898598.43	100617.30	904145.53	39
22	11089.08	99383.26	11157.89	896226.68	100620.56	907188.37	38
23	11117.99	99380.03	11187.34	893867.26	100623.83	899443.54	37
24	11146.89	99376.79	11216.79	891520.08	100627.11	897110.95	36
25	11175.80	99373.54	11246.25	889185.05	100630.40	894790.51	35
26	11204.71	99370.28	11275.71	886862.06	100633.70	892482.11	34
27	11233.61	99367.02	11305.17	884551.03	100637.01	890185.67	33
28	11262.52	99363.75	11334.63	882251.86	100640.32	887901.09	32
29	11291.42	99360.47	11364.09	879964.46	100643.64	885628.28	31
30	11320.32	99357.18	11393.56	877688.74	100646.97	883367.15	30
31	11349.22	99353.88	11423.03	875424.61	100650.31	881117.61	29
32	11378.12	99350.58	11452.50	873171.98	100653.66	878879.57	28
33	11407.02	99347.27	11481.97	870930.77	100657.02	876652.95	27
34	11435.92	99343.95	11511.44	868700.88	100660.39	874437.66	26
35	11464.82	99340.62	11540.91	866482.23	100663.77	872233.61	25
36	11493.71	99337.28	11570.39	864274.75	100667.15	870040.71	24
37	11522.61	99333.93	11599.87	862078.33	100670.54	867858.89	23
38	11551.51	99330.57	11629.35	859892.90	100673.94	865688.05	22
39	11580.40	99327.20	11658.83	857718.38	100677.35	863528.12	21
40	11609.29	99323.83	11688.31	855554.68	100680.77	861379.01	20
41	11638.18	99320.45	11717.80	853401.72	100684.20	859240.65	19
42	11667.07	99317.06	11747.29	851259.43	100687.64	857112.95	18
43	11695.96	99313.66	11776.78	849127.72	100691.08	854995.84	17
44	11724.85	99310.25	11806.28	847006.51	100694.53	852889.23	16
45	11753.74	99306.84	11835.78	844895.73	100697.99	850793.04	15
46	11782.63	99303.42	11865.28	842795.31	100701.46	848707.21	14
47	11811.51	99299.99	11894.78	840705.15	100704.94	846631.65	13
48	11840.40	99296.55	11924.28	838625.19	100708.43	844566.29	12
49	11869.28	99293.10	11953.78	836555.36	100711.93	842511.05	11
50	11898.16	99289.64	11983.28	834495.57	100715.44	840465.86	10
51	11927.04	99286.17	12012.79	832445.77	100718.96	838430.65	9
52	11955.93	99282.70	12042.30	830405.86	100722.48	836405.34	8
53	11984.81	99279.22	12071.81	828375.79	100726.01	834389.86	7
54	12013.68	99275.73	12101.32	826355.47	100729.55	832384.15	6
55	12042.56	99272.23	12130.84	824344.85	100733.10	830388.12	5
56	12071.44	99268.72	12160.36	822343.84	100736.66	828401.71	4
57	12100.31	99265.21	12189.88	820352.39	100740.23	826424.85	3
58	12129.19	99261.69	12219.40	818370.41	100743.81	824457.48	2
59	12158.06	99258.16	12248.93	816397.86	100747.40	822499.52	1
60	12186.93	99254.62	12278.46	814434.64	100750.99	820510.90	0

7	Sinus		Tangens		Secans		
0	12186.93	99254.62	12278.46	814434.64	100750.99	820550.90	60
1	12215.81	99251.07	12307.99	812480.71	100754.59	818611.57	59
2	12244.68	99247.51	12337.52	810535.99	100758.20	816681.45	58
3	12273.55	99243.94	12367.05	808600.42	100761.82	814760.48	57
4	12302.41	99240.36	12396.58	806673.94	100765.45	812848.60	56
5	12331.28	99236.78	12426.12	804756.47	100769.09	810945.73	55
6	12360.15	99233.19	12455.66	802847.96	100772.74	809051.82	54
7	12389.01	99229.59	12485.20	800948.35	100776.39	807166.81	53
8	12417.88	99225.98	12514.74	799057.56	100780.05	805290.62	52
9	12446.74	99222.36	12544.29	797175.55	100783.72	803423.21	51
10	12475.60	99218.74	12573.84	795302.24	100787.40	801564.50	50
11	12504.46	99215.11	12603.39	793437.58	100791.09	799714.45	49
12	12533.32	99211.47	12632.94	791581.51	100794.79	797872.98	48
13	12562.18	99207.82	12662.49	789733.96	100798.50	796040.03	47
14	12591.04	99204.16	12692.05	787894.89	100802.22	794215.56	46
15	12619.90	99200.49	12721.61	786064.23	100805.95	792399.50	45
16	12648.75	99196.81	12751.17	784241.91	100809.69	790591.79	44
17	12677.61	99193.13	12780.73	782427.90	100813.43	788792.38	43
18	12706.46	99189.44	12810.29	780622.12	100817.18	787001.20	42
19	12735.31	99185.74	12839.86	778824.53	100820.94	785218.21	41
20	12764.16	99182.03	12869.43	777035.06	100824.71	783443.35	40
21	12793.01	99178.31	12899.00	775253.66	100828.49	781676.56	39
22	12821.86	99174.59	12928.57	773480.28	100832.28	779917.78	38
23	12850.71	99170.86	12958.15	771714.86	100836.07	778166.97	37
24	12879.56	99167.12	12987.73	769957.35	100839.88	776424.06	36
25	12908.41	99163.37	13017.31	768207.69	100843.70	774689.01	35
26	12937.25	99159.61	13046.89	766465.84	100847.52	772961.76	34
27	12966.09	99155.84	13076.48	764731.74	100851.35	771242.27	33
28	12994.94	99152.06	13106.07	763005.33	100855.19	769530.47	32
29	13023.78	99148.28	13135.66	761286.57	100859.04	767826.31	31
30	13052.62	99144.49	13165.25	759575.41	100862.90	766129.76	30
31	13081.46	99140.69	13194.84	757871.79	100866.77	764440.75	29
32	13110.30	99136.88	13224.44	756175.67	100870.65	762759.23	28
33	13139.13	99133.06	13254.04	754486.99	100874.53	761085.16	27
34	13167.97	99129.23	13283.64	752805.71	100878.41	759418.49	26
35	13196.81	99125.39	13313.24	751131.78	100882.32	757759.16	25
36	13225.64	99121.55	13342.85	749465.14	100886.23	756107.13	24
37	13254.47	99117.70	13372.46	747805.76	100890.15	754462.36	23
38	13283.30	99113.84	13402.07	746153.57	100894.08	752824.78	22
39	13312.13	99109.97	13431.68	744508.55	100898.02	751194.37	21
40	13340.96	99106.09	13461.29	742870.64	100901.97	749571.06	20
41	13369.79	99102.21	13490.91	741239.78	100905.92	747954.82	19
42	13398.62	99098.32	13520.53	739615.95	100909.88	746345.60	18
43	13427.44	99094.42	13550.15	737999.09	100913.85	744743.35	17
44	13456.27	99090.51	13579.77	736389.16	100917.83	743148.03	16
45	13485.09	99086.59	13609.40	734786.10	100921.82	741559.59	15
46	13513.92	99082.66	13639.03	733189.89	100925.82	739977.98	14
47	13542.74	99078.72	13668.66	731600.47	100929.83	738403.18	13
48	13571.56	99074.78	13698.29	730017.80	100933.85	736835.12	12
49	13600.38	99070.83	13727.93	728441.84	100937.88	735273.77	11
50	13629.19	99066.87	13757.57	726872.55	100941.92	733719.09	10
51	13658.01	99062.90	13787.21	725309.87	100945.96	732171.02	9
52	13686.83	99058.92	13816.85	723753.78	100950.01	730629.54	8
53	13715.64	99054.93	13846.50	722204.22	100954.07	729094.60	7
54	13744.45	99050.94	13876.15	720661.16	100958.14	727566.16	6
55	13773.27	99046.94	13905.80	719124.56	100962.22	726044.17	5
56	13802.08	99042.93	13935.45	717594.37	100966.31	724528.59	4
57	13830.89	99038.91	13965.10	716070.56	100970.41	723019.40	3
58	13859.70	99034.88	13994.76	714553.08	100974.52	721516.53	2
59	13888.50	99030.84	14024.42	713041.90	100978.64	720019.96	1
60	13917.31	99026.80	14054.08	711536.97	100982.76	718529.65	0

8	Sinus		Tangens		Secans		
0	13917.31	99026.80	14054.08	711536.97	100982.76	718529.65	60
1	13946.12	99022.75	14083.74	710038.26	100986.89	717045.56	59
2	13974.92	99018.69	14113.41	708545.73	100991.03	715567.64	58
3	14003.72	99014.62	14143.08	707059.34	100995.18	714095.87	57
4	14032.52	99010.54	14172.75	705579.05	100999.34	712630.19	56
5	14061.32	99006.45	14202.43	704104.82	101003.51	711170.58	55
6	14090.12	99002.36	14232.11	702636.62	101007.69	709717.00	54
7	14118.92	98998.26	14261.79	701174.41	101011.88	708269.41	53
8	14147.72	98994.15	14291.47	699718.06	101016.07	706827.77	52
9	14176.51	98990.03	14321.15	698267.81	101020.27	705392.05	51
10	14205.31	98985.90	14350.84	696823.35	101024.48	703962.20	50
11	14234.10	98981.76	14380.53	695384.73	101028.70	702538.20	49
12	14262.89	98977.62	14410.22	693951.92	101032.93	701120.01	48
13	14291.68	98973.47	14439.91	692524.89	101037.17	699707.60	47
14	14320.47	98969.31	14469.61	691103.59	101041.42	698300.92	46
15	14349.26	98965.14	14499.31	689687.99	101045.68	696899.94	45
16	14378.05	98960.96	14529.01	688278.07	101049.95	695504.64	44
17	14406.84	98956.77	14558.71	686873.78	101054.23	694114.96	43
18	14435.62	98952.57	14588.42	685475.08	101058.51	692730.89	42
19	14464.40	98948.37	14618.13	684081.96	101062.80	691352.39	41
20	14493.19	98944.16	14647.84	682694.37	101067.10	689979.42	40
21	14521.97	98939.94	14677.55	681312.27	101071.41	688611.95	39
22	14550.75	98935.71	14707.27	679935.65	101075.73	687249.95	38
23	14579.53	98931.47	14736.99	678564.46	101080.06	685893.38	37
24	14608.30	98927.23	14766.71	677198.67	101084.40	684542.22	36
25	14637.08	98922.98	14796.44	675838.26	101088.75	683196.42	35
26	14665.85	98918.72	14826.17	674483.18	101093.11	681855.97	34
27	14694.63	98914.45	14855.90	673133.41	101097.47	680520.82	33
28	14723.40	98910.17	14885.63	671788.91	101101.84	679190.95	32
29	14752.17	98905.88	14915.36	670449.66	101106.22	677866.32	31
30	14780.94	98901.58	14945.10	669115.62	101110.61	676546.91	30
31	14809.71	98897.28	14974.84	667786.77	101115.01	675232.68	29
32	14838.48	98892.97	15004.58	666463.07	101119.42	673923.60	28
33	14867.24	98888.65	15034.33	665144.49	101123.84	672619.65	27
34	14896.01	98884.32	15064.08	663831.00	101128.27	671320.79	26
35	14924.77	98879.98	15093.83	662522.58	101132.71	670026.99	25
36	14953.53	98875.63	15123.58	661219.19	101137.15	668738.22	24
37	14982.30	98871.28	15153.33	659920.80	101141.60	667454.46	23
38	15011.06	98866.92	15183.09	658627.39	101146.06	666175.68	22
39	15039.81	98862.55	15212.85	657338.92	101150.53	664901.84	21
40	15068.57	98858.17	15242.61	656055.38	101155.02	663632.93	20
41	15097.33	98853.78	15272.38	654776.72	101159.50	662368.90	19
42	15126.08	98849.38	15302.15	653502.93	101164.00	661109.73	18
43	15154.84	98844.98	15331.92	652233.96	101168.51	659855.40	17
44	15183.59	98840.57	15361.89	650969.81	101173.03	658605.87	16
45	15212.34	98836.15	15391.47	649710.43	101177.56	657361.12	15
46	15241.09	98831.72	15421.25	648455.81	101182.09	656121.13	14
47	15269.84	98827.28	15451.03	647205.91	101186.63	654885.86	13
48	15298.58	98822.83	15480.82	645960.70	101191.18	653655.28	12
49	15327.33	98818.38	15510.61	644720.17	101195.74	652429.38	11
50	15356.07	98813.92	15540.40	643484.28	101200.31	651208.12	10
51	15384.82	98809.45	15570.19	642253.01	101204.89	649991.48	9
52	15413.56	98804.97	15599.98	641026.33	101209.48	648779.44	8
53	15442.30	98800.48	15629.78	639804.22	101214.08	647571.95	7
54	15471.04	98795.98	15659.58	638586.65	101218.69	646369.01	6
55	15499.78	98791.48	15689.38	637373.59	101223.31	645170.59	5
56	15528.51	98786.97	15719.19	636165.02	101227.93	643976.66	4
57	15557.25	98782.45	15749.00	634960.92	101232.56	642787.19	3
58	15585.98	98777.92	15778.81	633761.26	101237.20	641602.16	2
59	15614.72	98773.28	15808.62	632566.01	101241.85	640421.54	1
60	15643.45	98768.83	15838.44	631375.15	101246.51	639245.32	0
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9	Sinus		Tangens		Secans		
0	15643.45	98768.83	15838.44	631375.15	101246.51	639245.32	60
1	15672.18	98764.28	15868.26	630188.66	101251.18	638073.47	59
2	15700.91	98759.72	15898.08	629006.51	101255.86	636905.95	58
3	15729.63	98755.15	15927.91	627828.68	101260.55	635742.76	57
4	15758.36	98750.57	15957.74	626655.14	101265.25	634583.86	56
5	15787.08	98745.98	15987.57	625485.88	101269.96	633429.23	55
6	15815.81	98741.38	16017.40	624320.86	101274.67	632278.84	54
7	15844.53	98736.77	16047.24	623160.07	101279.39	631132.69	53
8	15873.25	98732.16	16077.08	622003.47	101284.12	629990.73	52
9	15901.97	98727.54	16106.92	620851.06	101288.86	628852.95	51
10	15930.69	98722.91	16136.77	619702.79	101293.61	627719.33	50
11	15959.40	98718.27	16166.62	618558.67	101298.37	626589.84	49
12	15988.12	98713.62	16196.47	617418.65	101303.14	625464.46	48
13	16016.83	98708.97	16226.32	616282.72	101307.92	624343.16	47
14	16045.55	98704.31	16256.17	615150.85	101312.71	623225.94	46
15	16074.26	98699.64	16286.03	614023.03	101317.51	622112.75	45
16	16102.97	98694.96	16315.89	612899.23	101322.31	621003.59	44
17	16131.67	98690.27	16345.76	611779.43	101327.12	619898.43	43
18	16160.38	98685.57	16375.63	610663.60	101331.94	618797.25	42
19	16189.09	98680.86	16405.50	609551.74	101336.77	617700.03	41
20	16217.79	89676.15	16435.37	608443.81	101341.61	616606.74	40
21	16246.50	98671.43	16465.25	607339.79	101346.46	615517.36	39
22	16275.20	98666.70	16495.13	606239.67	101351.32	614431.89	38
23	16303.90	98661.96	16525.01	605143.43	101356.19	613350.28	37
24	16332.60	98657.21	16554.89	604051.03	101361.07	612272.53	36
25	16361.29	98652.46	16584.78	602962.47	101365.95	611198.61	35
26	16389.99	98647.70	16614.67	601877.72	101370.84	610128.50	34
27	16418.68	98642.93	16644.56	600796.76	101375.74	609062.19	33
28	16447.38	98638.15	16674.46	599719.57	101380.65	607999.64	32
29	16476.07	98633.36	16704.36	598646.14	101385.57	606940.85	31
30	16504.76	98628.56	16734.26	597576.44	101390.50	605885.80	30
31	16533.45	98623.75	16764.16	596510.45	101395.44	604824.45	29
32	16562.14	98618.94	16794.07	595448.15	101400.39	603786.80	28
33	16590.82	98614.12	16823.98	594389.52	101405.35	602742.82	27
34	16619.51	98609.29	16853.89	593334.55	101410.32	601702.50	26
35	16648.19	98604.45	16883.81	592283.22	101415.30	600565.81	25
36	16676.87	98599.60	16913.73	591235.50	101420.29	599632.74	24
37	16705.55	98594.74	16943.65	590191.38	101425.29	598603.26	23
38	16734.23	98589.88	16973.58	589150.84	101430.29	597577.37	22
39	16762.91	98585.01	17003.51	588113.86	101435.30	596555.04	21
40	16791.59	98580.13	17033.44	587080.42	101440.32	595536.25	20
41	16820.26	98575.24	17063.37	586050.51	101445.35	594520.98	19
42	16848.94	98570.34	17093.31	585024.10	101450.39	593509.22	18
43	16877.61	98565.44	17123.25	584001.17	101455.44	592500.95	17
44	16906.28	98560.53	17153.19	582981.72	101460.50	591496.14	16
45	16934.95	98555.61	17183.14	581965.72	101465.57	590494.79	15
46	16963.62	98550.68	17213.09	580953.15	101470.64	589496.88	14
47	16992.28	98545.74	17243.04	579944.00	101475.72	588502.38	13
48	17020.95	98540.79	17273.00	578938.25	101480.81	587511.28	12
49	17049.61	98535.83	17302.96	577935.88	101485.91	586523.56	11
50	17078.28	98530.87	17332.92	576936.88	101491.02	585539.20	10
51	17106.94	98525.90	17362.88	575941.22	101496.14	584558.20	9
52	17135.60	98520.92	17392.85	574948.89	101501.27	583580.53	8
53	17164.25	98515.93	17422.82	573959.88	101506.41	582606.17	7
54	17192.91	98510.93	17452.79	572974.16	101511.56	581635.10	6
55	17221.56	98505.92	17482.77	571991.73	101516.72	580667.32	5
56	17250.22	98500.91	17512.75	571012.56	101521.89	579702.80	4
57	17278.87	98495.89	17542.73	570036.63	101527.07	578741.53	3
58	17307.52	98490.86	17572.72	569063.94	101532.26	577783.50	2
59	17336.17	98485.82	17602.71	568094.46	101537.46	576828.67	1
60	17364.82	98480.77	17632.70	567128.18	101542.67	575877.05	0

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10	Sinus		Tangens		Secans		
0	17364.82	98480.77	17632.70	567128.18	101542.67	575877.05	60
1	17393.46	98475.71	17662.69	566165.09	101547.88	574928.61	59
2	17422.11	98470.65	17692.69	565205.16	101553.10	573983.33	58
3	17450.75	98465.58	17722.69	564248.38	101558.33	573041.21	57
4	17479.39	98460.50	17752.69	563294.74	101563.57	572102.23	56
5	17508.03	98455.41	17782.70	562344.21	101568.82	571166.36	55
6	17536.67	98450.31	17812.71	561396.80	101574.08	570233.60	54
7	17565.31	98445.21	17842.72	560452.47	101579.35	569303.93	53
8	17593.95	98440.10	17872.74	559511.21	101584.63	568377.34	52
9	17622.58	98434.98	17902.76	558573.02	101589.92	567453.80	51
10	17651.21	98429.85	17932.78	557637.86	101595.21	566533.32	50
11	17679.84	98424.71	17962.81	556705.74	101600.51	565615.84	49
12	17708.47	98419.56	17992.84	555776.63	101605.82	564701.40	48
13	17737.10	98414.40	18022.87	554850.52	101611.14	563789.95	47
14	17765.73	98409.24	18052.91	553927.40	101616.47	562881.48	46
15	17794.35	98404.07	18082.95	553007.24	101621.81	561975.99	45
16	17822.98	98398.89	18112.99	552090.05	101627.16	561073.45	44
17	17851.60	98393.70	18143.03	551175.79	101632.52	560173.86	43
18	17880.22	98388.50	18173.08	550264.46	101637.89	559277.29	42
19	17908.84	98383.29	18203.13	549356.04	101643.27	558383.43	41
20	17937.46	98378.08	18233.18	548450.52	101648.66	557492.58	40
21	17966.07	98372.86	18263.24	547547.88	101654.06	556604.60	39
22	17994.69	98367.63	18293.30	546648.12	101659.46	555719.50	38
23	18023.30	98362.39	18323.36	545751.21	101664.87	554837.26	37
24	18051.91	98357.14	18353.43	544857.15	101670.29	553957.86	36
25	18080.52	98351.89	18383.50	543965.92	101675.72	553081.29	35
26	18109.13	98346.63	18413.57	543077.50	101681.16	552207.54	34
27	18137.74	98341.36	18443.65	542191.88	101686.61	551336.59	33
28	18166.35	98336.08	18473.73	541309.06	101692.07	550468.43	32
29	18194.95	98330.79	18503.81	540429.01	101697.54	549603.05	31
30	18223.55	98325.49	18533.90	539551.72	101703.02	541740.43	30
31	18252.15	98320.18	18563.99	538677.18	101708.51	547180.55	29
32	18280.75	98314.87	18594.08	537805.35	101714.01	547023.42	28
33	18309.35	98309.55	18624.18	536936.30	101719.52	546169.01	27
34	18337.95	98304.22	18654.28	536069.93	101725.04	545317.31	26
35	18366.54	98298.88	18684.38	535206.26	101730.56	544468.31	25
36	18395.13	98293.53	18714.49	534345.27	101736.09	543621.99	24
37	18423.73	98288.17	18744.60	533486.96	101741.62	542778.35	23
38	18452.32	98282.81	18774.71	532631.31	101747.18	541937.37	22
39	18480.91	98277.44	18804.83	531778.30	101752.74	541099.03	21
40	18509.49	98272.06	18834.95	530927.93	101758.31	540263.33	20
41	18538.08	98266.67	18865.07	530080.18	101763.89	539430.26	19
42	18566.66	98261.27	18895.20	529235.05	101769.48	538599.79	18
43	18595.24	98255.87	18925.33	528392.51	101775.08	537771.92	17
44	18623.82	98250.46	18955.46	527552.55	101780.69	536946.64	16
45	18652.40	98245.04	18985.59	526715.17	101786.31	536123.93	15
46	18680.98	98239.61	19015.73	525880.35	101791.94	535303.79	14
47	18709.56	98234.17	19045.87	525048.09	101797.58	534486.20	13
48	18738.13	98228.72	19076.02	524218.36	101803.22	533672.14	12
49	18766.70	98223.27	19106.17	523391.16	101808.87	532858.61	11
50	18795.27	98217.81	19136.32	522566.47	101814.53	532048.60	10
51	18823.84	98212.34	19166.48	521744.28	101820.20	531241.09	9
52	18852.41	98206.86	19196.64	520924.59	101825.88	530436.08	8
53	18880.98	98201.37	19226.80	520107.38	101831.57	529633.54	7
54	18909.54	98195.87	19256.96	519292.64	101837.27	528833.47	6
55	18938.11	98190.36	19287.13	518480.35	101842.98	528035.87	5
56	18966.67	98184.85	19317.30	517670.51	101848.70	527240.70	4
57	18995.23	98179.33	19347.48	516862.11	101854.43	526447.98	3
58	19023.79	98173.80	19377.66	516058.13	101860.17	525657.68	2
59	19052.34	98168.26	19407.84	515255.57	101865.92	524869.79	1
60	19080.90	98162.71	19438.03	514455.40	101871.68	524084.31	0
							79

11	Sinus		Tangens		Secans		
0	19080.90	98162.71	19438.03	514455.40	101871.68	524084.31	60
1	19109.45	98157.16	19468.22	513657.63	101877.44	523301.21	59
2	19138.00	98151.60	19498.41	512862.24	101883.21	522520.50	58
3	19166.55	98146.03	19528.61	512069.21	101888.90	521742.16	57
4	19195.10	98140.45	19558.81	511278.55	101894.78	520966.18	56
5	19223.65	98134.86	19589.01	510490.24	101900.58	520192.54	55
6	19252.20	98129.26	19619.22	509704.26	101906.39	519421.25	54
7	19280.74	98123.66	19649.43	508920.61	101912.21	518652.28	53
8	19309.28	98118.05	19679.64	508139.28	101918.04	517885.63	52
9	19337.82	98112.43	19709.86	507360.25	101923.88	517121.28	51
10	19366.36	98106.80	19740.08	506583.52	101929.73	516359.24	50
11	19394.90	98101.16	19770.30	505809.07	101935.59	515599.48	49
12	19423.44	98095.51	19800.53	505036.90	101941.46	514841.99	48
13	19451.97	98089.86	19830.76	504267.00	101947.34	514086.77	47
14	19480.50	98084.20	19861.00	503499.35	101953.23	513333.81	46
15	19509.03	98078.53	19891.24	502733.95	101959.12	512583.09	45
16	19537.56	98072.85	19921.48	501970.78	101965.02	511834.61	44
17	19566.09	98067.16	19951.72	501209.84	101970.93	511088.35	43
18	19594.61	98061.46	19981.97	500451.11	101976.85	510344.31	42
19	19623.14	98055.76	20012.22	499694.59	101982.78	509602.48	41
20	19651.66	98020.05	20042.48	498940.27	101988.72	508862.84	40
21	19680.18	98044.33	20072.74	498188.13	101994.67	508125.39	39
22	19708.70	98038.60	20103.00	497438.17	102000.63	507390.12	38
23	19737.22	98032.86	20133.27	496690.37	102006.60	506657.01	37
24	19765.73	98027.11	20163.54	495944.74	102012.58	505926.06	36
25	19794.25	98021.36	20193.81	495201.25	102018.57	505197.26	35
26	19822.76	98015.60	20224.09	494459.90	102024.57	504470.60	34
27	19851.27	98009.83	20254.37	493720.68	102030.58	503746.07	33
28	19879.78	98004.05	20284.65	492983.58	102036.60	503023.67	32
29	19908.29	97998.26	20314.94	492248.59	102042.63	502303.37	31
30	19936.79	97992.47	20345.23	491515.70	102048.67	501585.17	30
31	19965.30	97986.67	20375.52	490784.91	102054.71	500869.07	29
32	19993.80	97980.86	20405.82	490056.20	102060.76	500155.05	28
33	20022.30	97975.04	20436.12	480329.56	102066.82	499443.11	27
34	20050.80	97969.21	20466.43	488604.99	102072.89	498733.23	26
35	20079.30	97963.37	20496.74	487882.48	102078.97	498025.41	25
36	20107.79	97957.52	20527.05	487162.01	102085.06	497319.64	24
37	20136.29	97951.67	20557.37	486443.59	102091.16	496615.91	23
38	20164.78	97945.81	20587.69	485727.19	102097.27	495914.21	22
39	20193.27	97939.94	20618.01	485012.82	102103.39	495214.53	21
40	20221.76	97934.06	10648.34	484300.45	102109.52	494516.87	20
41	20250.24	97928.17	10678.67	483590.10	102115.66	493821.20	19
42	20278.73	97922.28	20709.00	482881.74	102121.81	493127.54	18
43	20307.21	97916.38	20739.34	482175.36	102127.97	492435.86	17
44	20335.69	97910.47	20769.68	481470.96	102134.14	491746.16	16
45	20364.17	97904.55	20800.03	480768.54	102140.32	491058.44	15
46	20392.65	97898.62	20830.38	480068.08	102146.50	490372.67	14
47	20421.13	97892.68	20860.73	479369.57	102152.69	489688.86	13
48	20449.61	97886.74	20891.09	478673.00	102158.89	489007.00	12
49	20478.08	97880.79	20921.45	477978.37	102165.10	488327.07	11
50	20506.55	97874.83	20951.81	477285.67	102171.32	487649.07	10
51	20535.02	97868.86	20982.18	476594.90	102177.55	486972.99	9
52	20563.49	97862.88	21012.55	475906.03	102183.79	486298.83	8
53	20591.95	97856.89	21042.93	475219.07	102190.04	485626.57	7
54	20620.42	97850.90	21073.31	474534.01	102196.30	484956.21	6
55	20648.88	97844.90	21103.69	473850.85	102202.57	484287.74	5
56	20677.34	97838.89	21134.07	473169.54	102208.85	483621.14	4
57	20705.80	97832.87	21164.46	472490.12	102215.14	482956.43	3
58	20734.26	97826.84	21194.85	471812.56	102221.44	482293.57	2
59	20762.71	97820.80	21225.25	471136.86	102227.75	481632.58	1
60	20791.17	97814.76	21255.65	470463.01	102234.07	480973.43	0

12	Sinus		Tangens		Secans		
0	20791.17	97814.76	21255.65	470463.01	102234.07	480972.43	60
1	20819.62	97808.71	21286.06	469791.00	102240.40	480316.13	59
2	20848.07	97802.65	21316.47	469120.83	102246.73	479660.66	58
3	20876.52	97796.58	21346.88	468452.48	102253.07	479007.02	57
4	20904.97	97790.50	21377.30	467785.95	102259.42	478355.20	56
5	20933.41	97784.41	21407.72	467121.24	102265.78	477705.19	55
6	20961.86	97778.32	21438.14	466458.32	102272.15	477056.99	54
7	20990.30	97772.22	21468.57	465797.21	102278.53	476410.58	53
8	21018.74	97766.11	21499.00	465137.88	102284.92	475765.96	52
9	21047.18	97759.99	21529.44	464480.34	102291.32	475123.12	51
10	21075.61	97753.86	21559.88	463824.57	102297.73	474482.06	50
11	21104.[illegible]5	97747.73	21590.32	463170.56	102304.15	473842.77	49
12	21132.48	97741.59	21620.77	462518.32	102310.58	473205.23	48
13	21160.91	97735.44	21651.22	461867.83	102317.02	472569.45	47
14	21189.34	97729.28	21681.67	461219.08	102323.47	471935.42	46
15	21217.77	97723.11	21712.13	460572.07	102329.93	471303.13	45
16	21246.19	97716.93	21742.59	459926.80	102336.40	470672.56	44
17	21274.62	97710.75	21773.06	459283.25	102342.88	470043.72	43
18	21303.04	97704.56	21803.53	458641.41	102349.37	469416.60	42
19	21331.46	97698.36	21834.00	458001.29	102355.87	468791.19	41
20	21359.88	97692.15	21864.48	457362.87	102362.38	468167.48	40
21	21388.29	97685.93	21894.96	456726.14	102368.90	467545.48	39
22	21416.71	97679.70	21925.44	456091.11	102375.43	466925.16	38
23	21445.12	97673.47	21955.93	455457.76	102381.96	466306.52	37
24	21473.53	97667.23	21986.42	454826.08	102388.50	465689.56	36
25	21501.94	97660.98	22016.92	454196.08	102395.05	465074.27	35
26	21530.35	97654.72	22047.42	453567.73	102401.61	464460.64	34
27	21558.76	97648.45	22077.93	452941.05	102408.18	463848.67	33
28	21587.16	97642.17	22108.44	452316.01	102414.76	463238.35	32
29	21615.56	97635.89	22138.95	451692.61	102421.35	462629.67	31
30	21643.96	97629.60	22169.47	451070.85	102427.95	462022.63	30
31	21672.36	97623.30	22199.99	450450.72	102434.56	461417.22	29
32	21700.76	97616.99	22230.51	449832.21	102441.18	460813.43	28
33	21729.15	97610.67	22261.04	449215.32	102447.81	460211.26	27
34	21757.54	97604.35	22291.57	448600.04	102454.45	459610.70	26
35	21785.93	97598.02	22322.11	447986.36	102461.10	459011.74	25
36	21814.32	97591.68	22352.65	447374.28	102467.76	458414.39	24
37	21842.71	97585.33	22383.19	446763.79	102474.43	457818.62	23
38	21871.10	97578.97	22413.74	446154.89	102481.11	457224.44	22
39	21899.48	97572.60	22444.29	445547.56	102487.80	456631.83	21
40	21927.86	97566.23	22474.85	444941.81	102494.49	456040.80	20
41	21956.24	97559.85	22505.41	444337.62	102501.19	455451.34	19
42	21984.62	97553.46	22535.97	443734.99	102507.90	454863.44	18
43	22013.00	97547.06	22566.54	443133.92	102514.62	454277.09	17
44	22041.37	97540.65	22597.11	442534.39	102521.35	453692.29	16
45	22069.74	97534.23	22627.69	441936.41	102528.09	453109.03	15
46	22098.11	97527.81	22658.27	441339.96	102534.84	452527.30	14
47	22126.48	97521.38	22688.85	440745.04	102541.60	451947.11	13
48	22154.85	97514.94	22719.44	440151.64	102548.37	451368.44	12
49	22183.21	97508.49	22750.03	419559.76	102555.15	450791.29	11
50	22211.58	97502.03	22780.63	438969.40	102561.94	450215.65	10
51	22239.94	97495.56	22811.23	438380.54	102568.74	449641.52	9
52	22268.30	97489.09	22841.83	437793.17	102575.55	449068.89	8
53	22296.66	97482.61	22872.44	437207.31	102582.37	448497.75	7
54	22325.01	97476.12	22903.05	436622.93	102589.20	447928.10	6
55	22353.37	97469.62	22933.67	436040.03	102596.04	447359.93	5
56	22381.72	97463.11	22964.29	435458.61	102602.89	446793.24	4
57	22410.07	97456.60	22994.92	434878.66	102609.75	446228.03	3
58	22438.41	97450.08	23025.55	434300.18	102616.62	445664.28	2
59	22466.76	97443.55	23056.18	433725.16	102623.50	445101.98	1
60	22495.11	97437.01	23086.82	433147.59	102630.39	444541.15	0

13	Sinus		Tangens		Secans		
0	22495.11	97437.01	23086.82	433147.59	102630.39	444541.15	60
1	22523.45	97430.46	23117.46	432573.47	102637.29	443981.76	59
2	22551.79	97423.90	23148.11	432000.79	102644.20	443423.82	58
3	22580.13	97417.34	23178.76	431429.55	102651.12	442867.31	57
4	22608.46	97410.77	23209.41	430859.74	102658.05	442312.24	56
5	22636.80	97404.19	23240.07	430291.36	102664.99	441758.59	55
6	22665.13	97397.60	23270.73	429724.40	102671.94	441206.37	54
7	22693.46	97391.00	23301.40	429158.85	102678.90	440655.56	53
8	22721.79	97384.39	23332.07	428594.72	102685.87	440106.16	52
9	22750.12	97377.78	23362.74	428031.99	102692.84	439558.17	51
10	22778.44	97371.16	23393.42	427470.66	102699.82	439011.58	50
11	22806.77	97364.53	23424.10	426910.72	102706.81	438466.38	49
12	22835.09	97357.89	23454.79	426352.18	102713.81	437922.57	48
13	22863.41	97351.24	23485.48	425795.01	102720.82	437380.15	47
14	22891.72	97344.58	23516.17	425239.23	102727.84	436839.10	46
15	22920.04	97337.92	23546.87	424684.82	102734.87	436299.43	45
16	22948.35	97331.25	23577.58	424131.77	102741.91	435761.13	44
17	22976.66	97324.57	23608.29	423580.09	102748.96	435224.19	43
18	23004.97	97317.88	23639.00	423029.77	102756.02	434688.61	42
19	23033.28	97311.18	23669.72	422480.80	102763.09	434154.38	41
20	23061.59	97304.48	23700.44	421933.18	102770.17	433621.50	40
21	23089.89	97297.77	23731.16	421386.90	102777.26	433089.96	39
22	23118.19	97291.05	23761.89	420841.96	102784.36	432559.77	38
23	23146.49	97284.32	23792.62	420298.35	102791.47	432030.90	37
24	23174.79	97277.58	23823.36	419756.06	102798.59	431503.36	36
25	23203.09	97270.84	23854.10	419215.10	102805.72	430977.15	35
26	23231.38	97264.09	23884.85	418675.46	102812.86	430452.25	34
27	23259.67	97257.33	23915.60	418137.13	102820.01	429928.67	33
28	23287.96	97250.56	23946.35	417600.11	102827.17	429406.40	32
29	23316.25	97243.78	23977.11	417064.40	102834.34	428885.43	31
30	23344.54	97236.99	24007.87	416529.98	102841.52	428365.76	30
31	23372.82	97230.19	24038.64	415996.85	102848.71	427847.38	29
32	23401.10	97223.39	24069.41	415465.01	102855.91	427330.29	28
33	23429.38	97216.58	24100.19	414934.46	102863.12	426814.49	27
34	23457.66	97209.76	24130.97	414405.19	102870.34	426299.96	26
35	23485.94	97202.93	24161.76	413877.19	102877.57	425786.71	25
36	23514.21	97196.09	24192.55	413350.46	102884.81	425274.74	24
37	23542.48	97189.25	24223.34	412824.99	102892.06	424764.02	23
38	23570.75	97182.40	24254.14	412300.79	102899.32	424254.57	22
39	23599.02	97175.54	24284.94	411777.84	102906.58	423746.37	21
40	23627.29	97168.67	24315.75	411256.14	102913.85	423239.43	20
41	23655.55	97161.79	24346.56	410735.69	102921.13	422733.73	19
42	23683.81	97154.91	24377.37	410216.49	102928.42	422229.28	18
43	23712.07	97148.02	24408.19	409698.52	102935.72	421726.06	17
44	23740.33	97141.12	24439.01	409181.78	102943.03	421224.08	16
45	23768.59	97134.21	24469.84	408666.27	102950.35	420723.33	15
46	23796.84	97127.29	24500.67	408151.99	102957.68	420223.80	14
47	23825.10	97120.36	24531.51	407638.92	102965.02	419725.49	13
48	23853.35	97113.43	24562.35	407127.07	102972.37	419228.40	12
49	23881.59	97106.49	24593.20	406616.43	102979.73	418732.52	11
50	23909.84	97099.54	24624.05	406107.00	102987.10	418237.85	10
51	23938.08	97092.58	24654.91	405598.77	102994.48	417744.38	9
52	23966.33	97085.61	24685.77	405091.74	103001.87	417252.10	8
53	23994.57	97078.63	24716.63	404585.90	103009.27	416761.02	7
54	24022.80	97071.65	24747.50	404081.25	103016.68	416271.14	6
55	24051.04	97064.66	24778.37	403577.79	103024.10	415782.43	5
56	24079.27	97057.66	24809.25	403075.50	103031.53	415294.91	4
57	24107.51	97050.65	24840.13	402574.40	103038.97	414808.56	3
58	24135.74	97043.63	24871.02	402074.46	103046.42	414323.39	2
59	24163.96	97036.60	24901.91	401575.70	103053.88	413839.39	1
60	24192.19	97029.57	24932.80	401078.09	103061.35	413356.55	0

14	Sinus		Tangens		Secans		
0	24192.19	97029.57	24932.80	401078.09	103061.35	413356.55	60
1	24220.41	97022.53	24963.70	400581.65	103068.83	412874.87	59
2	24248.63	97015.48	24994.60	400086.36	103076.32	412394.35	58
3	24276.85	97008.42	25025.51	399592.23	103083.82	411914.98	57
4	24305.07	97001.35	25056.42	399099.24	103091.33	411436.75	56
5	24333.29	96994.28	25087.34	398607.39	103098.85	410959.67	55
6	24361.50	96987.20	25118.26	398116.69	103106.38	410483.74	54
7	24389.71	96980.11	25149.19	397627.12	103113.92	410008.93	53
8	24417.92	96973.01	25180.12	397138.68	103121.47	409535.26	52
9	24446.13	96965.90	25211.06	396651.37	103129.03	409062.72	51
10	24474.33	96958.79	25242.00	396165.18	103136.60	408591.30	50
11	24502.54	96951.67	25272.94	395680.11	103144.18	408121.00	49
12	24530.74	96944.54	25303.89	395196.15	103151.77	407651.81	48
13	24558.94	96937.40	25334.84	394713.31	103159.36	407183.74	47
14	24587.13	96930.25	25365.80	394231.57	103166.97	406716.77	46
15	24615.33	96923.09	25396.76	393750.94	103174.59	406250.91	45
16	24643.52	96915.92	25427.73	393271.41	103182.22	405786.15	44
17	24671.71	96908.75	25458.70	392792.97	103189.85	405322.49	43
18	24699.90	96901.57	25489.68	392315.63	103197.50	404859.92	42
19	24728.09	96894.38	25520.66	391839.37	103205.16	404398.44	41
20	24756.27	96887.18	25551.65	391364.20	103212.82	403938.04	40
21	24784.45	96879.98	25582.64	390890.11	103220.50	403478.72	39
22	24812.63	96872.77	25613.63	390417.10	103228.18	403020.48	38
23	24840.81	96865.55	25644.63	389945.16	103235.88	402563.32	37
24	24868.99	96858.32	25675.63	389474.29	103243.59	402107.22	36
25	24897.16	96851.08	25706.64	389004.48	103251.30	401652.19	35
26	24925.33	96843.83	25737.66	388535.74	103259.03	401198.23	34
27	24953.50	96836.57	25768.68	388068.05	103266.76	400745.32	33
28	24981.67	96829.31	25799.70	387601.42	103274.51	400293.47	32
29	25009.84	96822.04	25830.73	387135.84	103282.27	399842.67	31
30	25038.00	96814.76	25861.76	386671.31	103290.03	399392.92	30
31	25066.16	96807.47	25892.80	386207.82	103297.81	398944.21	29
32	25094.32	96800.18	25923.84	385745.37	103305.59	398496.54	28
33	25122.48	96792.88	25954.88	385283.96	103313.39	398049.91	27
34	25150.63	96785.57	25985.93	384823.58	103321.19	397604.31	26
35	25178.79	96778.25	26016.99	384364.24	103329.01	397159.75	25
36	25206.94	96770.92	26048.05	383905.91	103336.83	396716.21	24
37	25235.08	96763.58	26079.11	383448.61	103344.67	396273.69	23
38	25263.23	96756.23	26110.18	382992.33	103352.51	395832.19	22
39	25291.37	96748.88	26141.26	382537.07	103360.37	395391.71	21
40	25319.52	96741.52	26172.34	381082.81	103368.23	394952.24	20
41	25347.66	96734.15	26203.42	381629.57	103376.11	394513.79	19
42	25375.79	96726.77	26234.51	381177.33	103383.99	394076.33	18
43	25403.93	96719.38	26265.60	380726.09	103391.88	393639.88	17
44	25432.06	96711.99	26296.70	380275.85	103399.79	393204.43	16
45	25460.19	96704.59	26327.80	379826.61	103407.70	392769.97	15
46	25488.32	96697.18	26358.91	379378.35	103415.63	392336.51	14
47	25516.45	96689.76	26390.02	378931.09	103423.56	391904.03	13
48	25544.58	96682.33	26421.14	378484.81	103431.51	391472.54	12
49	25572.70	96674.90	26452.26	378039.51	103439.46	391042.03	11
50	25600.82	96667.46	26483.39	377595.19	103447.43	390612.50	10
51	25628.94	96660.01	26514.52	377151.85	103455.40	390183.95	9
52	25657.05	96652.55	26545.66	376709.47	103463.38	389756.37	8
53	25685.17	96645.08	26576.80	376268.07	103471.38	389329.76	7
54	25713.28	96637.60	26607.94	375827.63	103479.38	388904.11	6
55	25741.39	96630.12	26639.09	375388.15	103487.40	388479.43	5
56	25769.50	96622.63	26670.25	374949.63	103495.42	388055.70	4
57	25797.60	96615.13	26701.41	374512.07	103503.46	387632.93	3
58	25825.70	96607.62	26732.57	374075.46	103511.50	387211.12	2
59	25853.81	96600.10	26763.74	373639.80	103519.55	386790.25	1
60	25881.90	96592.58	26794.92	373205.08	103527.62	386370.33	0

15	Sinus		Tangens		Secans		
0	25881.90	96592.58	26794.92	373205.08	103527.61	386370.33	60
1	25910.00	96585.05	26826.10	372771.31	103535.69	385951.35	59
2	25938.10	96577.51	26857.25	372338.47	103543.78	385533.32	58
3	25966.19	96569.96	26888.47	371906.58	103551.87	385116.22	57
4	25994.28	96562.40	26919.67	371475.61	103559.98	384700.05	56
5	26022.37	96554.82	26950.87	371045.58	103568.09	384284.82	55
6	26050.45	96547.26	26982.07	370616.48	103576.21	383870.51	54
7	26078.53	96539.68	27013.28	370188.30	103584.35	383457.13	53
8	26106.61	96532.09	27044.49	369761.03	103592.49	383044.67	52
9	26134.69	96524.49	27075.71	369334.69	103600.65	382633.13	51
10	26162.77	96516.88	27106.93	368909.27	103608.81	382222.51	50
11	26190.85	96509.27	27138.16	368484.75	103616.99	381812.80	49
12	26218.92	96501.65	27169.40	368061.15	103625.17	381403.99	48
13	26246.99	96494.02	27200.64	367638.45	103633.37	380996.10	47
14	26275.06	96486.38	27231.88	367216.65	103641.57	380589.11	46
15	26303.12	96478.73	27263.13	366795.75	103649.79	380183.01	45
16	26331.18	96471.07	27294.38	366375.75	103658.01	379777.82	44
17	26359.24	96463.41	27325.64	365956.65	103666.25	379373.52	43
18	26387.30	95455.74	27356.90	365538.44	103674.49	378970.11	42
19	26415.36	96448.06	27388.17	365121.11	103682.75	378567.60	41
20	26443.42	96440.37	27419.44	364704.67	103691.01	378165.96	40
21	26471.47	96432.67	27450.72	364289.11	103699.29	377765.22	39
22	26499.52	96424.97	27482.01	363874.44	103707.57	377365.35	38
23	26527.57	96417.26	27513.30	363460.64	103715.87	376966.36	37
24	26555.61	96409.54	27544.59	363047.71	103724.17	376568.24	36
25	26583.65	96401.81	27575.89	362635.66	103732.49	376171.00	35
26	26611.69	96394.07	27607.19	362224.47	103740.82	375774.62	34
27	26639.73	96386.33	27638.50	361814.15	103749.15	375379.11	33
28	26667.77	96378.58	27669.81	361404.69	103757.50	374984.47	32
29	26695.81	96370.82	27701.13	360996.09	103765.85	374590.68	31
30	26723.84	96363.05	27732.45	360588.35	103774.22	374197.75	30
31	26751.87	96355.27	27763.78	360181.46	103782.60	373805.68	29
32	26779.89	96347.48	27795.12	359775.43	103790.98	373414.46	28
33	26807.92	96339.69	27826.46	359370.24	103799.38	373024.09	27
34	26835.94	96331.89	27857.80	358965.90	103807.79	372634.57	26
35	26863.96	96324.08	27889.15	358562.41	103816.21	372245.89	25
36	26891.98	96316.26	27920.50	358159.75	103824.63	371858.05	24
37	26920.00	96308.43	27951.86	357757.94	103833.07	371471.05	23
38	26948.01	96300.59	27983.22	357356.96	103841.52	371084.89	22
39	26976.02	96292.75	28014.59	356956.81	103849.98	370699.56	21
40	27004.03	96284.90	28045.97	356557.49	103858.44	370315.06	20
41	27032.04	96277.04	28077.35	356159.00	103866.92	369931.39	19
42	27060.04	96269.17	28108.73	355761.33	103875.41	369548.54	18
43	27088.05	96261.30	28140.12	355364.49	103883.91	369166.52	17
44	27116.05	96253.42	28171.52	354968.46	103892.42	368785.32	16
45	27144.04	96245.53	28202.92	354573.25	103900.94	368404.93	15
46	27172.04	96237.63	28234.32	354178.86	103909.47	368025.36	14
47	27200.03	96229.72	28265.73	353785.28	103918.00	367646.60	13
48	27228.02	96221.80	28297.15	353392.51	103926.55	367268.65	12
49	27256.01	96213.87	28328.57	353000.54	103935.11	366891.51	11
50	27284.00	96205.94	28359.99	352609.38	103943.68	366515.18	10
51	27311.98	96198.00	28391.42	352219.02	103952.26	366139.64	9
52	27339.96	96190.05	28422.86	351829.46	103960.85	365764.91	8
53	27367.94	96182.09	28454.30	351440.70	103969.45	365390.97	7
54	27395.92	96174.13	28485.75	351052.73	103978.06	365017.83	6
55	27423.90	96166.16	28517.20	350665.55	103986.69	364645.48	5
56	27451.87	96158.18	28548.66	350279.16	103995.32	364273.92	4
57	27479.84	96150.19	28580.12	349893.56	104003.96	363903.15	3
58	27507.81	96142.19	28611.59	349508.74	104012.61	363533.16	2
59	27535.78	96134.18	28643.06	349124.70	104021.27	363163.95	1
60	27563.74	96126.17	28674.54	348741.44	104029.94	362795.53	0

16	Sinus		Tangens		Secans		
0	27563.74	96126.17	28674.54	348741.44	104029.94	362795.53	60
1	27591.70	96118.15	28706.02	348358.96	104038.63	362427.88	59
2	27619.65	96110.12	28737.51	347977.26	104047.32	362061.01	58
3	27647.61	96102.08	28769.00	347596.32	104056.02	361694.90	57
4	27675.56	96094.03	28800.50	347216.16	104064.73	361329.57	56
5	27703.52	96085.98	28832.01	346836.76	104073.46	360965.01	55
6	27731.47	96077.92	28863.52	346458.13	104082.19	360601.21	54
7	27759.41	96069.85	28895.03	346080.26	104090.94	360238.18	53
8	27787.36	96061.77	28926.55	345703.15	104099.69	359875.90	52
9	27815.30	96053.68	28958.08	345326.79	104108.45	359514.39	51
10	27843.24	96045.58	28989.61	344951.20	104117.23	359153.63	50
11	27871.18	96037.48	29021.14	344576.35	104126.01	358793.62	49
12	27899.11	96029.37	29052.68	344202.26	104134.81	358434.37	48
13	27927.04	96021.25	29084.23	343828.91	104143.62	358075.86	47
14	27954.97	96013.12	29115.78	343456.31	104152.43	357718.10	46
15	27982.90	96004.98	29147.34	343084.46	104161.26	357361.08	45
16	28010.83	95996.84	29178.90	342713.34	104170.09	357004.81	44
17	28038.75	95988.69	29210.47	342342.97	104178.94	356649.28	43
18	28066.67	95980.53	29242.05	341973.33	104187.80	356294.48	42
19	28094.59	95972.36	29273.63	341604.43	104196.67	355940.42	41
20	28122.51	95964.18	29305.21	341236.26	104205.54	355587.10	40
21	28150.42	95956.00	29336.80	340868.82	104814.43	355234.50	39
22	28178.33	95947.81	29368.39	340502.10	104223.33	354882.63	38
23	28206.24	95939.61	29399.99	340136.12	104232.24	354531.49	37
24	28234.15	95931.40	29431.60	339770.85	104241.16	354181.07	36
25	28262.05	95923.18	29463.21	339406.31	104250.09	353831.38	35
26	28289.95	55914.95	29494.83	339042.49	104259.03	353482.40	34
27	28317.85	95906.72	29526.45	338679.38	104267.98	353134.14	33
28	28345.75	95898.48	29558.08	338316.99	104276.94	352786.60	32
29	28373.64	95890.23	29589.71	337955.31	104285.91	352439.77	31
30	28401.53	95881.97	29621.35	337594.34	104294.89	352094.65	30
31	28429.42	95873.70	29652.99	337234.08	104303.88	351748.24	29
32	28457.31	95865.43	92684.64	336874.53	104312.89	351403.54	28
33	28485.20	95857.15	29716.30	336515.68	104321.90	351059.54	27
34	28513.08	95848.86	29747.96	336157.53	104330.92	350716.25	26
35	28540.96	95840.56	29779.62	335800.08	104339.95	350373.65	25
36	28568.84	95832.25	29811.29	335443.33	104349.00	350031.75	24
37	28596.71	95823.94	29842.97	335087.28	104358.05	349690.55	23
38	28624.58	95815.62	29874.65	334731.91	104367.12	349350.04	22
39	28652.45	95807.29	29906.34	334377.24	104376.19	349010.23	21
40	28680.32	95798.95	29938.03	334023.26	104385.28	348671.10	20
41	28708.19	95790.60	29969.73	333669.97	104394.37	348132.67	19
42	28736.05	95782.25	30001.44	333317.36	104403.48	347994.92	18
43	28763.91	95773.89	30033.15	332965.43	104412.59	347657.85	17
44	28791.77	95765.52	30064.86	332614.19	104421.72	347321.46	16
45	28819.63	95757.14	30096.58	332263.62	104430.86	346985.76	15
46	28847.48	95748.75	30128.31	331913.73	104440.01	346650.73	14
47	28875.33	95740.35	30160.04	331564.52	104449.17	346316.37	13
48	28903.18	95731.95	30191.78	331215.98	104458.33	345982.69	12
49	28931.03	95723.54	30223.52	330868.11	104467.51	345649.69	11
50	28958.87	95715.12	30255.27	330520.91	104476.70	345317.35	10
51	28986.71	95706.69	30287.03	330174.38	104485.90	344985.68	9
52	29014.55	95698.25	30318.79	329828.51	104495.11	344654.67	8
53	29042.39	95689.81	30350.55	329483.30	104504.33	344324.33	7
54	29070.22	95681.36	30382.32	329138.76	104513.57	343994.65	6
55	29098.05	95672.90	30414.10	328794.87	104522.81	343665.63	5
56	29125.88	95664.43	30445.88	328451.64	104532.06	343337.27	4
57	29153.71	95655.95	30477.67	328109.07	104541.32	343009.56	3
58	29181.53	95647.47	30509.46	327767.15	104550.60	342682.51	2
59	29209.35	95638.98	30541.26	327425.88	104559.88	342356.11	1
60	29237.17	95630.48	30573.07	327085.26	104569.18	342030.36	0

17	Sinus		Tangens		Secans		
0	29237.17	95630.48	30573.07	327085.26	104569.18	342030.36	60
1	29264.99	95621.97	30604.88	326745.29	104578.48	341705.26	59
2	29292.80	95613.45	30636.69	326405.96	104587.80	341380.80	58
3	29320.61	95604.92	30668.51	326067.28	104597.12	341056.99	57
4	29348.42	95596.39	30700.34	325729.24	104606.46	340733.82	56
5	29376.23	95587.85	30732.18	325391.84	104615.81	340411.30	55
6	29404.03	95579.30	30764.02	325055.08	104625.16	340089.41	54
7	29431.83	95570.74	30795.86	324718.95	104534.53	339768.16	53
8	29459.63	95562.17	30827.71	324383.46	104643.91	339447.54	52
9	29487.43	95553.60	30859.57	324048.60	104653.30	339127.55	51
10	29515.22	95545.02	30891.43	323714.38	104662.70	338808.20	50
11	29543.01	95536.43	30923.30	323380.78	104672.11	338489.48	49
12	29570.80	95527.83	30955.37	323047.80	104681.53	338171.38	48
13	29598.59	95519.22	30987.05	322715.46	104690.96	337853.91	47
14	29626.38	95510.61	31018.93	322383.73	104700.40	337537.07	46
15	29654.16	95501.99	31050.82	322052.63	104709.86	337220.84	45
16	29681.94	95493.36	31082.72	321722.15	104719.32	336905.24	44
17	29709.71	95484.72	31114.62	321392.28	104728.79	336590.26	43
18	29737.49	95476.07	31146.53	321063.04	104738.28	336275.89	42
19	29765.26	95467.42	31178.44	320734.40	104747.77	335962.14	41
20	29793.03	95458.76	31210.36	320406.38	104757.28	335649.00	40
21	29820.79	95450.09	31242.29	320078.97	104766.79	335336.47	39
22	29848.56	95441.41	31274.22	319752.17	104776.32	335024.55	38
23	29876.32	95432.72	31306.16	314425.98	104785.86	334713.24	37
24	29904.08	95424.03	31338.10	319100.39	104795.40	334402.54	36
25	29931.84	95415.33	31370.05	318775.40	104804.96	334092.44	35
26	29959.59	95406.62	31402.00	318451.02	104814.53	333782.94	34
27	29987.34	95397.90	31433.96	318127.24	104824.11	333474.05	33
28	30015.09	95389.17	31465.93	317804.06	104833.70	333165.75	32
29	30042.84	95380.43	31497.90	317481.47	104843.30	332858.05	31
30	30070.58	95371.69	31529.88	317159.48	104852.91	332550.95	30
31	30098.32	95362.94	31561.86	316838.08	104862.53	332244.44	29
32	30126.06	95354.18	31593.85	316517.28	104872.17	331938.53	28
33	30153.80	95345.41	31625.85	316197.06	104881.81	331633.20	27
34	30181.53	95336.64	31657.85	315877.44	104891.46	331328.47	26
35	30209.26	95327.86	31689.86	315558.40	104901.13	331024.32	25
36	30236.99	95319.07	31721.87	315239.94	104910.80	330720.76	24
37	30264.71	95310.27	31753.89	314922.07	104920.49	330417.78	23
38	30292.44	95301.46	31785.91	314604.78	104930.19	330115.39	22
39	30320.16	95292.64	31817.94	314288.07	104939.89	329813.57	21
40	30347.88	95283.82	31849.98	313971.94	104949.61	329512.34	20
41	30375.59	95274.99	31882.02	313656.39	104959.34	329211.68	19
42	30403.31	95266.15	31914.07	313341.41	104969.08	328911.60	18
43	30431.02	95257.30	31946.13	313027.01	104978.83	328612.09	17
44	30458.72	95248.44	31978.19	312713.17	104988.59	328313.16	16
45	30486.43	95239.58	32010.25	312399.91	104998.36	328014.79	15
46	30514.13	95230.71	32042.32	312087.22	105008.15	327717.00	14
47	30541.84	95221.83	32074.40	311775.09	105017.94	327419.77	13
48	30569.53	95212.94	32106.49	311463.53	105027.74	427125.11	12
49	30597.23	95204.04	32138.58	311152.54	105037.58	326827.02	11
50	30624.92	95195.14	32170.67	310842.10	105047.38	326531.49	10
51	30652.61	95186.23	32202.77	310532.23	105057.22	326236.52	9
52	30680.29	95177.31	32234.88	310222.91	105067.06	325942.11	8
53	30707.98	95168.38	32267.00	309914.16	105076.92	325648.25	7
54	30735.66	95159.44	32299.12	309605.96	105086.79	325354.96	6
55	30763.34	95150.49	32331.25	309298.31	105096.67	325062.22	5
56	30791.08	95141.54	32363.38	308991.22	105106.56	324770.03	4
57	30818.69	95132.58	32395.52	308684.68	105116.46	324478.40	3
58	30846.36	95123.61	32427.66	308378.69	105126.37	324187.32	2
59	30874.03	95114.63	32459.81	308073.25	105136.29	323896.78	1
60	30901.70	95105.65	32491.97	307768.35	105146.22	323605.80	0

18	Sinus		Tangens		Secans		
0	30901.70	95105.65	32491.97	307768.35	105146.22	323606.80	60
1	30929.36	95096.66	32524.13	307464.00	105156.17	323317.36	59
2	30957.02	95087.66	32556.30	307160.20	105166.12	323028.46	58
3	30984.68	95078.65	32588.48	306856.93	105176.08	322740.11	57
4	31012.34	95069.63	32620.66	306554.21	105186.06	322452.30	56
5	31039.99	95060.60	32652.85	306252.03	105196.05	322165.03	55
6	31067.64	95051.57	32685.04	305950.38	105206.04	321878.30	54
7	31095.29	95042.53	32717.24	305649.28	105216.05	321592.10	53
8	31122.94	95033.48	32749.44	305348.70	105226.07	321306.44	52
9	31150.58	95024.42	32781.65	305048.66	105236.10	321021.32	51
10	31178.22	95015.36	32813.87	304749.15	105246.14	320736.73	50
11	31205.86	95006.29	32846.10	304450.18	105256.19	320452.66	49
12	31233.49	94997.21	32878.33	304151.73	105266.25	320169.13	48
13	31261.12	94988.12	32910.56	303853.81	105276.33	319886.13	47
14	31288.75	94979.02	32942.80	303556.41	105286.41	319603.65	46
15	31316.38	94969.91	32975.05	303259.54	105296.51	319321.70	45
16	31344.00	94960.80	33007.31	302963.20	105306.61	319040.28	44
17	31371.63	94951.68	33039.57	302667.37	105316.73	318759.37	43
18	31399.25	94942.55	33071.84	302372.07	105326.86	318478.99	42
19	31426.86	94933.41	33104.11	302077.28	105336.99	318199.13	41
20	31454.48	94924.26	33136.39	301783.01	105347.14	317919.78	40
21	31482.09	94915.11	33168.68	301489.26	105357.30	317640.95	39
22	31509.69	94905.95	33200.97	301196.02	105367.47	317362.64	38
23	31537.30	94896.78	33233.27	300903.30	105377.65	317084.84	37
24	31564.90	94887.60	33265.57	300611.09	105387.85	316807.56	36
25	31592.50	94878.41	33297.88	300319.39	105398.05	316530.78	35
26	31620.10	94869.22	33330.20	300028.20	105408.26	316254.52	34
27	31647.70	94860.02	33362.52	299737.51	105418.49	315978.76	33
28	31675.29	94850.81	33394.85	299447.34	105428.73	315703.51	32
29	31702.88	94841.59	33427.19	299157.66	105438.97	315428.77	31
30	31730.47	94832.36	33459.53	298868.50	105449.23	315154.53	30
31	31758.05	94823.13	33491.88	298579.83	105459.50	314880.79	29
32	31785.63	94813.89	33524.24	298291.66	105469.78	314607.56	28
33	31813.21	94804.64	33556.60	298004.00	105480.07	314334.83	27
34	31840.79	94705.38	33588.97	297716.83	105490.37	314062.59	26
35	31868.36	94786.11	33621.34	297430.16	105500.68	313790.86	25
36	31895.93	94776.84	33653.72	297143.99	105511.01	313519.62	24
37	31923.50	94767.56	33686.11	296858.31	105521.34	313248.87	23
38	31951.06	94758.27	33718.50	296573.12	105531.69	312978.62	22
39	31978.63	94748.97	33750.90	296288.42	105542.04	312708.86	21
40	32006.19	94739.66	33783.30	296004.22	105552.41	312439.59	20
41	32033.74	94730.35	33815.71	295720.50	105562.79	312170.81	19
42	32061.30	94721.03	33848.13	295437.27	105573.18	311902.52	18
43	32088.85	94711.70	33880.56	295154.53	105583.58	311634.72	17
44	32116.40	94702.36	33912.99	294872.27	105593.99	311367.40	16
45	32143.95	94693.01	33945.43	294590.50	105604.41	311100.57	15
46	32171.49	94683.66	33977.87	294309.21	105614.85	310834.22	14
47	32199.03	94674.30	34010.32	294028.40	105625.29	310568.55	13
48	32226.57	94664.93	34042.78	293748.07	105635.75	310302.96	12
49	32254.10	94655.55	34075.24	293468.22	105646.21	310038.05	11
50	32281.64	94646.16	34107.71	293188.85	105656.69	309773.63	10
51	32309.17	94636.76	34140.19	292909.95	105667.18	309509.67	9
52	32336.70	94627.36	34172.67	292631.52	105677.68	309246.20	8
53	32364.22	94617.95	34205.16	292353.58	105688.19	308983.19	7
54	32391.74	94608.53	34237.65	292076.10	105698.71	308720.66	6
55	32419.26	94599.10	34270.15	291799.09	105709.24	308458.60	5
56	32446.78	94589.67	34302.66	291522.56	105719.78	308197.02	4
57	32474.29	94580.23	34335.18	291246.49	105730.34	307935.90	3
58	32501.80	94570.78	34367.70	290970.89	105740.90	307675.25	2
59	32529.31	94561.32	34400.23	290695.76	105751.48	307415.07	1
60	32556.82	94551.85	34432.76	290421.09	105762.07	307155.35	0

19	Sinus		Tangens		Secans		
0	32556.82	94551.85	34432.76	290421.09	105761.07	307153.35	60
1	32584.32	94542.38	34465.30	290146.88	105772.67	306896.10	59
2	32611.82	94532.90	34497.85	289873.14	105783.28	306637.31	58
3	32639.31	94523.41	34530.40	289599.86	105793.90	306378.98	57
4	32666.81	94513.91	34562.96	289327.04	105804.53	306121.11	56
5	32694.30	94504.40	34595.53	289054.67	105815.17	305863.70	55
6	32721.79	94494.89	34628.10	288782.77	105825.83	305606.75	54
7	32749.28	94485.37	34660.68	288511.32	105836.49	305350.26	53
8	32776.76	94475.84	34693.27	288240.33	105847.17	305094.23	52
9	32804.24	94466.30	34725.86	287969.79	105857.86	304838.64	51
10	32831.72	94456.75	34758.46	287699.70	105868.55	304583.52	50
11	32859.19	94447.20	34791.07	287430.07	105879.26	304328.84	49
12	32886.66	94437.64	34823.68	287160.88	105889.99	304074.62	48
13	32914.13	94428.07	34856.30	286892.15	105900.72	303820.84	47
14	32941.60	94418.49	34888.93	286623.86	105911.46	303567.52	46
15	32969.06	94408.90	34921.56	286356.02	105922.21	303314.64	45
16	32996.52	94399.31	34954.20	286088.63	105932.98	303062.21	44
17	33023.98	94389.71	34986.85	285821.68	105943.76	302810.23	43
18	33051.44	94380.10	35019.50	285555.17	105954.54	302558.68	42
19	33078.89	94370.48	35052.16	285289.11	105965.34	302307.59	41
20	33106.34	94360.85	35084.83	285023.49	105976.15	302056.93	40
21	33133.79	94351.21	35117.50	284758.31	105986.97	301806.72	39
22	33161.23	94341.57	35150.18	284493.56	105997.81	301556.94	38
23	33188.67	94331.92	35182.87	284229.26	106008.65	301307.60	37
24	33216.11	94322.26	35215.56	283965.39	106019.51	301058.70	36
25	33243.55	94312.60	35248.26	283701.96	106030.37	300810.24	35
26	33270.98	94302.93	35280.97	283438.96	106041.25	300562.21	34
27	33298.41	94293.25	35313.68	283176.39	106052.14	300314.62	33
28	33325.84	94283.56	35346.40	282914.26	106063.04	300067.45	32
29	33353.27	94273.86	35379.13	282652.56	106073.95	299820.73	31
30	33380.69	94264.15	35411.86	282391.29	106084.87	299574.43	30
31	33408.10	94254.43	35444.60	282130.45	106095.80	299328.56	29
32	33435.52	94244.71	35477.35	281870.03	106106.75	299083.12	28
33	33462.93	94234.98	35510.10	281610.04	106117.70	298838.11	27
34	33490.34	94225.24	35542.86	281350.48	106128.67	298593.52	26
35	33517.75	94215.50	35575.63	281091.34	106139.65	298349.36	25
36	33545.16	94205.75	35608.40	280832.63	106150.64	298105.63	24
37	33572.56	94195.99	35641.18	280574.33	106161.64	297862.31	23
38	33599.96	94186.22	35673.97	280316.46	106172.65	297619.42	22
39	33627.35	94176.44	35706.76	280059.01	106183.67	297376.95	21
40	33654.75	94166.65	35739.56	279801.98	106194.71	297134.90	20
41	33682.14	94156.85	35772.37	279545.37	106205.75	296893.27	19
42	33709.53	94147.05	35805.18	279289.17	106216.81	296652.05	18
43	33736.91	94137.24	35838.00	279033.39	106227.88	296411.25	17
44	33764.29	94127.42	35870.83	278778.02	106238.96	296170.87	16
45	33791.67	94117.60	35903.67	278523.07	106250.05	295930.90	15
46	33819.05	94107.77	35936.51	278268.53	106261.15	295691.35	14
47	33846.42	94097.93	35969.36	278014.40	106272.27	295452.21	13
48	33873.79	94088.08	36002.22	277760.69	106283.39	295213.48	12
49	33901.16	94078.22	36035.08	277507.38	106294.53	294975.16	11
50	33928.53	94068.35	36067.95	277254.48	106305.68	294737.25	10
51	33955.89	94058.48	36100.83	277001.99	106316.84	294499.75	9
52	33983.25	94048.60	36133.71	276749.90	106328.01	294262.65	8
53	34010.60	94038.71	36166.60	276498.22	106339.19	294025.97	7
54	34037.95	94028.81	36199.50	276246.95	106350.38	293789.68	6
55	34065.30	94018.90	36232.40	275996.08	106361.58	293553.80	5
56	34092.65	94008.99	36265.31	275745.61	106372.80	293318.33	4
57	34120.00	93999.07	36298.23	275495.54	106384.03	293083.26	3
58	34147.34	93989.14	36331.15	275245.88	106395.27	292848.58	2
59	34174.68	93979.20	36364.08	274996.61	106406.52	292614.31	1
60	34202.02	93969.26	36397.02	274747.74	106417.78	292380.44	0

20	Sinus		Tangens		Secans		
0	34202.02	93969.26	36397.02	274747.74	106417.78	292380.44	60
1	34229.35	93959.31	36429.97	274499.27	106429.05	292146.97	59
2	34256.68	93949.35	36462.92	274251.20	106440.33	291913.89	58
3	34284.01	93939.38	36495.88	274003.52	106451.63	291681.21	57
4	34311.33	93929.40	36528.85	273756.23	106462.94	291448.92	56
5	34338.65	93919.42	36561.82	273509.34	106474.26	291217.03	55
6	34365.97	93909.43	36594.80	273262.84	106485.59	290985.53	54
7	34393.29	93899.43	36627.79	273016.74	106496.93	290754.43	53
8	34420.60	93889.42	36660.79	272771.02	106508.28	290523.72	52
9	34447.91	93879.40	36693.79	272525.69	106519.64	290293.39	51
10	34475.22	93869.37	36726.80	272280.75	106531.01	290063.46	50
11	34502.52	93859.34	36759.82	272036.20	106542.40	289833.91	49
12	34529.82	93849.30	36792.84	271792.04	106553.80	289604.75	48
13	34557.12	93839.25	36825.87	271548.26	106565.21	289375.98	47
14	34584.42	93829.19	36858.91	271304.87	106576.63	289147.60	46
15	34611.71	93819.13	36891.95	271061.86	106583.07	288919.59	45
16	34639.00	93809.06	36925.00	270819.23	106599.51	288691.98	44
17	34666.29	93798.98	36958.06	270576.99	106610.97	288464.74	43
18	34693.57	93788.89	36991.13	270335.13	106622.43	288237.89	42
19	34720.85	93778.79	37024.20	270093.64	106633.91	288011.42	41
20	34748.13	93768.69	37057.28	269852.54	106645.40	287785.32	40
21	34775.40	93758.58	37090.37	269611.81	106656.90	287559.61	39
22	34802.67	93748.46	37123.46	269371.47	106668.42	287334.28	38
23	34829.94	93738.33	37156.56	269131.49	106679.94	287109.32	37
24	34857.21	93728.19	37189.67	268891.90	106691.48	286884.74	36
25	34884.47	93718.05	37222.78	268652.67	106703.02	286660.53	35
26	34911.73	93707.90	37255.90	268413.83	106714.58	286436.70	34
27	34938.99	93697.74	37289.03	268175.35	106726.15	286213.24	33
28	34966.24	93687.57	37322.17	267937.25	106737.74	285990.15	32
29	34993.49	93677.40	37355.32	267699.51	106749.34	285767.44	31
30	35020.74	93667.22	37388.47	267462.15	106760.94	285545.09	30
31	35047.99	93657.03	37421.63	267225.16	106772.55	285323.12	29
32	35075.23	93646.83	37454.79	266988.53	106784.18	285101.52	28
33	35102.47	93636.62	37487.97	266752.27	106795.81	284880.28	27
34	35129.70	93626.40	37521.15	266516.38	106807.47	284659.41	26
35	35156.93	93616.18	37554.34	266280.85	106819.14	284438.91	25
36	35184.16	93605.95	37587.53	266045.69	106830.82	284218.77	24
37	35211.39	93595.71	37620.73	265810.89	106842.50	283998.99	23
38	35238.62	93585.46	37653.94	265576.45	106854.20	283779.58	22
39	35265.84	93575.21	37687.16	265342.38	106865.91	283560.54	21
40	35293.06	93564.95	37720.38	265108.67	106877.63	283341.85	20
41	35320.27	93554.68	37753.61	264875.31	106889.36	283123.53	19
42	35347.48	93544.40	37786.85	264642.32	106901.10	282905.56	18
43	35374.69	93534.11	37820.10	264409.69	106912.86	282687.96	17
44	35401.90	93523.82	37853.35	264177.41	106924.63	282470.71	16
45	35429.10	93513.52	37886.61	263945.49	106936.41	282253.82	15
46	35456.30	93503.21	37919.88	263713.92	106948.20	282037.29	14
47	35483.50	93492.89	37953.16	263482.71	106960.00	281821.11	13
48	35510.70	93482.56	37986.44	263251.86	106971.82	281605.29	12
49	35537.89	93472.23	38019.73	263021.36	106983.64	281389.82	11
50	35565.08	93461.89	38053.03	262791.21	106995.48	281174.71	10
51	35592.26	93451.54	38086.33	262561.41	107007.33	280959.95	9
52	35619.44	93441.18	38119.64	262331.96	107019.19	280745.34	8
53	35646.62	93430.82	38152.96	262102.86	107031.06	280531.48	7
54	35673.80	93410.45	38186.29	261874.11	107042.95	280317.77	6
55	35700.97	93410.07	38219.62	261645.71	107054.84	280104.41	5
56	35728.14	93399.68	38252.96	261417.66	107066.75	279891.40	4
57	35755.31	93389.28	38286.31	261189.95	107078.67	279678.73	3
58	35782.48	93378.87	38319.67	260962.59	107090.60	279466.41	2
59	35809.64	93368.46	38353.03	260735.58	107102.54	279254.44	1
60	35836.79	93358.04	38386.40	260508.91	107114.50	279042.81	0

21	Sinus		Tangens		Secans		
0	35836.79	93358.04	38386.40	260508.91	107114.50	279042.81	60
1	35863.95	93347.61	38419.78	260282.58	107126.47	278831.53	59
2	35891.10	93337.17	38453.17	260056.59	107138.44	278620.59	58
3	35918.25	93326.73	38486.56	259830.95	107150.43	278409.99	57
4	35945.40	93316.28	38519.96	259605.64	107162.44	278199.73	56
5	35972.54	93305.82	38553.37	259380.68	107174.45	277989.82	55
6	35999.68	93295.35	38586.79	259156.06	107186.47	27[illegible]80.24	54
7	36026.82	93284.87	38620.21	258931.77	107198.51	277571.00	53
8	36053.95	91274.39	38653.64	258707.82	107210.56	277362.11	52
9	36081.08	93263.90	38687.08	258484.21	107222.62	277153.55	51
10	36108.21	93253.40	38720.53	258260.94	107234.69	276945.32	50
11	36135.33	93242.89	38753.98	258038.00	107246.78	276737.43	49
12	36162.46	93232.38	38787.44	257815.39	107258.87	276529.88	48
13	36189.58	93221.86	38820.91	257593.12	107270.98	276322.66	47
14	36216.69	93211.33	38854.39	257371.18	107283.10	276115.78	46
15	36243.80	93200.79	38887.87	257149.57	107295.23	275909.23	45
16	36270.91	93190.24	38921.36	256928.30	107307.37	275703.01	44
17	36298.02	93179.68	38954.86	256707.35	107319.53	275497.12	43
18	36325.12	98169.12	38988.37	256486.74	107331.70	275291.57	42
19	36352.22	93158.55	39021.89	256266.45	107343.88	275086.34	41
20	36379.32	93147.97	30055.41	256046.49	107356.07	274881.44	40
21	36406.41	93137.38	39088.94	255826.86	107368.27	274676.87	39
22	36433.50	93126.79	39122.48	255607.56	107380.48	274472.63	38
23	36460.59	93116.19	39156.02	255388.58	107392.71	274268.71	37
24	36487.68	93105.58	39189.57	255169.92	107404.95	274065.12	36
25	36514.76	93094.96	39223.13	254951.60	107417.20	273861.86	35
26	36541.84	93084.33	39256.70	254733.59	107429.46	273658.92	34
27	36568.92	93073.70	39290.28	254515.91	107441.73	273456.30	33
28	36595.99	93063.06	39323.86	254298.55	107454.02	273254.00	32
29	36623.06	93052.41	39357.45	254081.51	107466.31	273052.03	31
30	36650.13	93041.75	39391.05	253864.79	107478.62	272850.38	30
31	36677.19	93031.09	39424.66	253648.39	107490.95	272649.05	29
32	36704.25	93020.42	39458.27	253432.31	107503.28	272448.04	28
33	36731.31	93009.74	39491.89	253216.55	107515.62	272247.35	27
34	36758.36	92999.05	39525.52	253001.11	107527.98	272046.98	26
35	36785.41	92988.35	39559.16	252785.98	107540.35	271846.93	25
36	36812.46	92977.65	39592.80	252571.17	107552.73	271647.19	24
37	36839.50	92966.94	39626.45	252356.67	107565.12	271447.77	23
38	36866.54	92956.22	39660.11	252142.49	107577.53	271248.66	22
39	36893.58	92945.49	39693.78	251928.63	107589.95	271049.87	21
40	36920.62	92934.75	39727.46	251715.07	107602.37	270851.39	20
41	36947.65	92924.01	39761.14	251501.83	107614.81	270653.23	19
42	36974.68	92913.26	39794.83	251288.90	107627.27	270455.38	18
43	37001.70	92902.50	39828.53	251076.29	107639.73	270257.84	17
44	37028.72	92891.73	39862.24	250863.98	107652.21	270060.61	16
45	37055.74	92880.95	39895.96	250651.98	107664.70	269863.70	15
46	37082.76	92870.17	39929.68	250440.29	107677.20	269667.09	14
47	37109.77	92859.38	39963.41	250228.91	107689.71	269470.79	13
48	37136.78	92848.58	39997.15	250017.84	107702.24	269274.80	12
49	37163.79	92837.77	40030.89	249807.07	107714.77	269079.12	11
50	37190.80	92826.96	40064.65	249596.61	107727.32	268883.74	10
51	37217.80	92816.14	40098.41	249386.45	107739.88	268688.67	9
52	37244.80	92805.31	40132.18	249176.60	107752.46	268493.91	8
53	37271.79	92794.47	40165.96	248967.06	107765.04	268299.45	7
54	37298.78	92783.62	40199.75	248757.81	107777.64	268105.30	6
55	37325.77	92772.77	40233.54	248548.87	107790.25	267911.45	5
56	37352.75	92761.91	40267.34	248340.23	107802.87	267717.90	4
57	37379.73	92751.04	40301.15	248131.90	107815.50	267524.65	3
58	37406.71	92740.16	60334.97	247923.86	107828.15	267331.70	2
59	37433.69	92729.28	40368.79	247716.12	107840.80	267139.06	1
60	37460.66	92718.39	40402.62	247508.69	107853.47	266946.72	0

22	Sinus		Tangens		Secans		
0	37460.66	92718.39	40402.62	247508.89	107853.47	266946.72	60
1	37487.63	92707.49	40436.46	247301.55	107866.16	266754.67	59
2	37514.59	92696.58	40470.31	247094.70	107878.85	266562.92	58
3	37541.56	92685.66	40504.17	246888.16	107891.56	266371.48	57
4	37568.52	92674.73	40538.04	246681.91	107904.27	266180.33	56
5	37595.47	92663.80	40571.91	246475.96	107917.00	265989.47	55
6	37622.[illegible]	92652.86	40605.79	246270.30	107929.75	265798.91	54
7	37649.38	92641.91	40639.68	246064.94	107942.50	265608.65	53
8	37676.32	92630.96	40673.58	245859.87	107955.27	265418.68	52
9	37703.27	92620.00	40707.48	245655.09	107968.05	265229.02	51
10	37730.21	92609.03	40741.39	245450.61	107980.84	265039.62	50
11	37757.14	92598.05	40775.31	245246.42	107993.64	264850.54	49
12	37784.08	92587.06	40809.24	245042.52	108006.46	264661.74	48
13	37811.01	92576.06	40843.18	244838.91	108019.28	264473.23	47
14	37837.94	92565.06	40877.13	244635.59	108032.12	264285.02	46
15	37864.86	92554.05	40911.08	244432.56	108044.97	264097.09	45
16	37891.78	92543.03	40945.04	244229.82	108057.84	263909.46	44
17	37918.70	92532.00	40979.01	244027.36	108070.71	263722.11	43
18	37945.62	92520.97	41012.99	243825.19	108083.60	263535.05	42
19	37972.53	92509.92	41046.97	243623.31	108096.50	263348.28	41
20	37999.44	92498.88	41080.97	243421.72	108109.42	263161.80	40
21	38026.34	92487.82	41114.97	243220.41	108122.34	262975.60	39
22	38053.24	92476.75	41148.98	243019.38	108135.28	262789.69	38
23	38080.14	92465.68	41183.00	242818.64	108148.23	262604.06	37
24	38107.04	92454.60	41217.03	242618.19	108161.19	262418.72	36
25	38133.93	92443.51	41251.06	242418.01	108174.17	262233.66	35
26	38160.82	92432.41	41285.10	242218.12	108187.15	262048.88	34
27	38187.70	92421.31	41319.15	242018.51	108200.15	261864.39	33
28	38214.59	92410.20	41353.21	241819.18	108213.16	261680.18	32
29	38241.47	92399.08	41387.28	241620.13	108226.18	261496.24	31
30	38268.34	92387.95	41421.36	241421.36	108239.22	261312.59	30
31	38295.22	92376.81	41455.44	241222.86	108252.27	261129.22	29
32	38322.09	92365.67	41489.53	241024.65	108265.33	260946.13	28
33	38348.95	92354.52	41523.63	240826.72	108278.40	260763.32	27
34	38375.82	92343.36	41557.74	240629.06	108291.49	260580.78	26
35	38402.68	92332.19	41591.86	240431.68	108304.58	260398.52	25
36	38429.53	92321.02	41625.99	240234.57	108317.69	260216.54	24
37	38456.39	92309.84	41660.12	240037.74	108330.81	260034.84	23
38	38483.24	92298.65	41694.26	239841.18	108343.95	259853.41	22
39	38510.08	92287.45	41728.41	239644.90	108357.09	259672.25	21
40	38536.93	92276.24	41762.57	239448.89	108370.25	259491.37	20
41	38563.77	92265.03	41796.74	239253.16	108383.42	259310.77	19
42	38590.60	92253.81	41830.91	239057.69	108396.61	259130.43	18
43	38617.44	92242.58	41865.09	238862.50	108409.80	258950.37	17
44	38644.27	92231.34	41899.28	238667.58	108423.01	258770.58	16
45	38671.10	92220.09	41933.48	238472.93	108436.23	258591.07	15
46	38697.92	92208.84	41967.69	238278.55	108449.47	258411.82	14
47	38724.74	92197.58	42001.91	238084.44	108462.71	258232.84	13
48	38751.56	92186.31	42036.13	237890.60	108475.97	258054.14	12
49	38778.37	92175.03	42070.36	237697.03	108489.24	257875.70	11
50	38805.18	92163.75	42104.60	237503.72	108502.52	257697.53	10
51	38831.99	92152.46	42138.85	237310.68	108515.82	257519.63	9
52	38858.80	92141.16	42173.11	237117.91	108529.13	257341.99	8
53	38885.60	92129.85	42207.38	236925.40	108542.45	257164.62	7
54	38912.39	92118.54	42241.66	236733.16	108555.78	256987.52	6
55	38939.19	92107.22	42275.94	236541.18	108569.12	256810.69	5
56	38965.98	92095.89	42310.23	236349.46	108582.48	256634.12	4
57	38992.77	92084.55	42344.53	236158.01	108595.85	256457.81	3
58	39019.55	92073.20	42378.84	235966.83	108609.24	256281.76	2
59	39046.33	92061.85	42413.16	235775.90	108622.63	256105.99	1
60	39073.11	92050.49	42447.49	235585.24	108636.04	255930.47	0

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23	Sinus		Tangens		Secans		
0	39073.31	92050.49	42447.49	235585.24	108636.04	255930.47	60
1	39099.89	92039.12	42481.82	235394.83	108649.46	255755.21	59
2	39126.66	92027.74	42516.16	235204.69	108662.89	255580.22	58
3	39153.43	92016.35	42550.51	235014.81	108676.34	255405.48	57
4	39180.19	92004.96	42584.87	234825.19	108689.79	255231.01	56
5	39206.95	91993.56	42619.24	234635.82	108703.26	255056.80	55
6	39233.71	91982.15	42653.62	234446.72	108716.75	254882.84	54
7	39260.47	91970.73	42688.00	234257.87	108730.24	254709.15	53
8	39287.22	91959.31	42722.39	234069.28	108743.75	254535.71	52
9	39313.97	91947.88	42756.79	233880.95	108757.27	254362.53	51
10	39340.71	91936.44	42791.20	233692.87	108770.80	254189.61	50
11	39367.45	91924.99	42825.62	233505.05	108784.35	254016.94	49
12	39394.19	91913.53	42860.05	233317.48	108797.91	253844.53	48
13	39420.93	91902.07	42894.49	233130.17	108811.48	253672.38	47
14	39447.66	91890.60	42928.94	232943.11	108825.06	253500.48	46
15	39474.39	91879.12	42963.39	232756.30	108838.66	253328.83	45
16	39501.11	91867.63	42997.85	232569.75	108852.27	253157.44	44
17	39527.83	91856.14	43032.32	232383.45	108865.89	252986.30	43
18	39554.55	91844.64	43066.80	232197.40	108879.52	252815.41	42
19	39581.27	91833.13	43101.29	232011.60	108893.17	252644.78	41
20	39607.98	91821.61	43135.79	231826.06	108906.83	252474.40	40
21	39634.69	91810.08	43170.30	231640.76	108920.50	252304.26	39
22	39661.39	91798.55	43204.81	231455.71	108934.18	252134.38	38
23	39688.09	91787.01	43239.33	231270.91	108947.88	251964.75	37
24	39714.79	91775.46	43273.86	231086.36	108961.59	251795.37	36
25	39741.48	91763.90	43308.40	230902.06	108975.31	251626.24	35
26	39768.17	91752.34	43342.95	230718.01	108989.04	251457.35	34
27	39794.86	91740.77	43377.51	230534.20	109002.79	251288.71	33
28	39821.55	91729.19	43412.08	230350.64	109016.55	251120.32	32
29	39848.23	91717.60	43446.66	230167.32	109030.32	250952.18	31
30	39874.91	91706.01	43481.24	229984.25	109044.11	250784.28	30
31	39901.58	91694.41	43515.83	229801.43	109057.91	250616.63	29
32	39928.25	91682.80	43550.43	229618.85	109071.72	250449.23	28
33	39954.92	91671.18	43585.04	229436.51	109085.54	250282.07	27
34	39981.58	91659.55	43619.66	229254.42	109099.38	250115.15	26
35	40008.24	91647.91	43654.29	229072.57	109113.23	249948.47	25
36	40034.90	91636.27	43688.93	228890.96	109127.09	249782.04	24
37	40061.56	91624.62	43723.58	228709.59	109140.97	249615.86	23
38	40088.21	91612.96	43758.23	228528.46	109154.86	249449.91	22
39	40114.86	91601.30	43792.89	228347.58	109168.76	249284.21	21
40	40141.50	91589.63	43827.56	228166.93	109182.67	249118.74	20
41	40168.14	91577.95	43862.24	227986.53	109196.59	248953.52	19
42	40194.78	91566.26	43896.93	227806.36	109210.53	248788.54	18
43	40221.41	91554.56	43931.63	227626.43	109224.48	248623.80	17
44	40248.04	91542.86	43966.34	227446.74	109238.45	248459.29	16
45	40274.67	91531.15	44001.06	227267.29	109252.43	248295.03	15
46	40301.29	91519.43	44035.78	227088.07	109266.42	248131.00	14
47	40327.91	91507.70	44070.51	226909.09	109280.42	247967.21	13
48	40354.53	91495.96	44105.25	226730.35	109294.44	247803.66	12
49	40381.14	91484.22	44140.00	226551.84	109308.47	247640.34	11
50	40407.75	91472.47	44174.76	226373.57	109322.51	247477.26	10
51	40434.36	91460.71	44209.53	226195.53	109336.56	247314.42	9
52	40460.96	91448.95	44244.31	226017.73	109350.63	247151.81	8
53	40487.56	91437.18	44279.10	225840.16	109364.71	246989.43	7
54	40514.16	91425.40	44313.90	225662.83	109378.80	246827.29	6
55	40540.75	91413.61	44348.71	225485.72	109392.91	246665.38	5
56	40567.34	91401.81	44383.53	225308.85	109407.03	246503.71	4
57	40593.93	91390.00	44418.35	225132.21	109421.16	246342.27	3
58	40620.51	91378.19	44453.18	224955.80	109435.30	246181.06	2
59	40647.09	91366.37	44488.02	224779.62	109449.46	246020.08	1
60	40673.66	91354.54	44522.87	224603.68	109463.63	245859.33	0

24	Sinus		Tangens		Secans		
0	40673.66	91354.54	44522.87	224603.68	109463.63	245859.33	60
1	40700.23	91342.71	44557.73	224427.96	109477.81	245698.82	59
2	40726.80	91330.87	44592.60	224252.47	109492.01	245538.58	58
3	40753.37	91319.02	44627.48	224077.21	109506.22	245378.48	57
4	40779.93	91307.16	44662.37	223902.18	109520.44	245218.65	56
5	40806.49	91295.29	44697.27	223727.38	109534.67	245059.05	55
6	40833.05	91283.42	44732.17	223552.80	109548.92	244899.68	54
7	40859.60	91271.54	44767.08	223378.45	109563.18	244740.54	53
8	40886.15	91259.65	44802.00	223204.33	109577.46	244581.63	52
9	40912.69	91247.75	44836.93	223030.43	109591.74	244422.94	51
10	40939.23	91235.84	44871.87	222856.76	109606.04	244264.48	50
11	40965.77	91223.93	44906.82	222683.31	109620.36	244106.24	49
12	40992.30	91212.01	44941.78	222510.09	109634.68	243948.23	48
13	41018.83	91200.08	44976.75	222337.09	109649.02	243790.45	47
14	41045.36	91188.14	45011.73	222164.32	109663.37	243632.89	46
15	41071.89	91176.20	45046.72	221991.77	109677.74	243475.55	45
16	41098.41	91164.25	45081.72	221819.44	109692.12	243318.44	44
17	41124.93	91152.29	45116.73	221647.33	109706.51	243161.55	43
18	41151.44	91140.32	45151.74	221475.45	109720.91	243004.89	42
19	41177.95	91128.35	45186.76	221303.79	109735.33	242848.44	41
20	41204.46	91116.37	45221.79	221132.34	109749.76	242692.22	40
21	41230.96	91104.38	45256.83	220961.12	109764.20	242536.22	39
22	41257.46	91092.38	45291.88	220790.12	109778.66	242380.44	38
23	41283.95	91080.38	45326.94	220619.34	109793.13	242224.88	37
24	41310.44	91068.37	45362.01	220448.78	109807.61	242069.54	36
25	41336.93	91056.35	45397.09	220278.43	109822.11	241914.42	35
26	41363.42	91044.32	45432.18	220108.31	109836.62	241759.52	34
27	41389.90	91032.28	45467.28	219938.40	109851.14	241604.84	33
28	41416.38	91020.24	45502.39	219768.71	109865.68	241450.38	32
29	41442.85	91008.19	45537.51	219599.23	109880.23	241296.13	31
30	41469.32	90996.13	45572.64	219429.97	109894.79	241142.10	30
31	41495.79	90984.06	45607.77	219260.93	109909.36	240988.29	29
32	41522.26	90971.98	45642.91	219092.10	109923.95	240834.69	28
33	41548.72	90959.90	45678.06	218923.49	109938.55	240681.32	27
34	41575.18	90947.81	45713.22	218755.10	109953.17	240528.15	26
35	41601.63	90935.71	45748.39	218586.91	109967.79	240375.20	25
36	41628.08	90923.61	45783.57	218418.94	109982.43	240222.47	24
37	41654.53	90911.50	45818.76	218251.19	109997.09	240069.95	23
38	41680.97	90899.38	45853.96	218083.64	110011.76	239917.64	22
39	41707.41	90887.25	45889.17	217916.31	110026.44	239765.55	21
40	41733.85	90875.11	45924.39	217749.20	110041.13	239613.67	20
41	41760.28	90862.97	45959.62	217582.29	110055.84	239462.01	19
42	41786.71	90850.82	45994.86	217415.59	110070.56	239310.55	18
43	41813.13	90838.66	46030.11	217249.11	110085.29	239159.31	17
44	41839.55	90826.49	46065.37	217082.83	110100.04	239008.28	16
45	41865.97	90814.32	46100.64	216916.77	110114.80	238857.46	15
46	41892.39	90802.14	46135.91	216750.91	110129.57	238706.85	14
47	41918.80	90789.95	46171.19	216585.27	110144.36	238556.45	13
48	41945.21	90777.75	46206.48	216419.83	110159.16	238406.25	12
49	41971.61	90765.54	46241.78	216254.60	110173.97	238256.27	11
50	41998.01	90753.33	46277.09	216089.58	110188.79	238106.50	10
51	42024.41	90741.11	46312.42	215924.76	110203.63	237956.93	9
52	42050.80	90728.88	46347.76	215760.15	110218.49	237807.58	8
53	42077.19	90716.64	46383.11	215595.75	110233.35	237658.43	7
54	42103.58	90704.40	46418.46	215431.56	110248.23	237509.49	6
55	42129.96	90692.15	46453.82	215267.57	110263.13	237360.95	5
56	42156.34	90679.89	46489.19	215103.78	110278.03	237212.22	4
57	42182.72	90667.62	46524.57	214940.20	110292.95	237063.90	3
58	42209.09	90655.35	46559.96	214776.83	110307.89	236915.78	2
59	42235.46	90643.07	46595.36	214613.66	110322.83	236767.87	1
60	42261.83	90630.78	46630.77	214450.69	110337.79	236620.16	0

25	Sinus		Tangens		Secans		
0	42261.83	90630.78	46630.77	214450.69	110337.79	236620.16	60
1	42288.19	90618.48	46666.19	214287.93	110352.77	236472.65	59
2	42314.55	90606.17	46701.62	214125.37	110367.75	236325.35	58
3	42340.90	90593.86	46737.06	213963.01	110382.75	236178.26	57
4	42367.25	90581.54	46772.51	213800.85	110397.77	236031.36	56
5	42393.60	90569.21	46807.97	213638.89	110412.79	235884.67	55
6	42419.94	90556.88	46843.43	213477.14	110427.83	235738.18	54
7	42446.28	90544.54	46878.90	213315.59	110442.89	235591.89	53
8	42472.62	90532.19	46914.38	213154.23	110457.95	235445.81	52
9	42498.95	90519.83	46949.88	212993.08	110473.03	235299.92	51
10	42525.28	90507.46	46985.39	212832.13	110488.13	235154.24	50
11	42551.61	90495.09	47020.90	212671.37	110503.24	235008.75	49
12	42577.93	90482.71	47056.43	212510.82	110518.36	234863.47	48
13	42604.25	90470.32	47091.96	212350.46	110533.49	234718.38	47
14	42630.56	90457.92	47127.51	212190.30	110548.64	234573.49	46
15	42656.87	90445.51	47163.06	212030.34	110563.80	234428.80	45
16	42683.18	90433.10	47198.63	211870.57	110578.98	234284.31	44
17	42709.49	90420.68	47234.20	211711.01	110594.17	234140.02	43
18	42735.79	90408.25	47269.78	211551.64	110609.37	233995.93	42
19	42762.09	90395.82	47305.38	211392.46	110624.58	233852.03	41
20	42788.38	90383.38	47340.98	211233.48	110639.81	233708.33	40
21	42814.67	90370.93	47376.59	211074.70	110655.06	233564.82	39
22	42840.95	90358.47	47412.22	210916.11	110670.31	233421.52	38
23	42867.23	90346.00	47447.85	210757.71	110685.58	233278.40	37
24	42893.51	90333.53	47483.49	210599.51	110700.87	233135.48	36
25	42919.79	90321.05	47519.14	210441.50	110716.16	232992.76	35
26	42946.06	90308.56	47554.81	210283.69	110731.47	232850.23	34
27	42972.33	90196.06	47590.48	210126.07	110746.80	232707.90	33
28	42998.59	90283.56	47626.16	209968.64	110762.14	232565.75	32
29	43024.85	90271.05	47661.85	209811.40	110777.49	232423.81	31
30	43051.11	90258.53	47697.55	209654.36	110792.85	232282.05	30
31	43077.36	90246.00	47733.26	209497.52	110808.23	232140.49	29
32	43103.61	90233.47	47768.99	209340.84	110823.63	231999.11	28
33	43129.86	90220.93	47804.72	209184.37	110839.03	231857.94	27
34	43156.10	90208.38	47840.46	209028.09	110854.45	231716.95	26
35	43182.34	90195.82	47876.21	208872.00	110869.89	231576.15	25
36	43208.57	90183.25	47911.97	208716.10	110885.33	231435.54	24
37	43234.80	90170.68	47947.74	208560.39	110900.79	231295.13	23
38	43261.03	90158.10	47983.52	208404.86	110916.27	231154.90	22
39	43287.26	90145.51	48019.32	208249.53	110931.76	231014.86	21
40	43313.48	90132.91	48055.12	208094.38	110947.26	230875.01	20
41	43339.70	90120.31	48090.93	207939.42	110962.77	230735.35	19
42	43365.91	90107.70	48126.75	207784.65	110978.30	230595.88	18
43	43392.12	90095.08	48162.58	207630.07	110993.85	230456.60	17
44	43418.33	90082.45	48198.42	207475.67	111009.41	230317.51	16
45	43444.53	90069.82	48234.27	207321.46	111024.98	230178.60	15
46	43470.73	90057.18	48270.14	207167.43	111040.56	230039.88	14
47	43496.92	90044.53	48306.01	207013.59	111056.16	229901.34	13
48	43523.11	90031.87	48341.89	206859.93	111071.77	229762.99	12
49	43549.30	90019.21	48377.78	206706.46	111087.40	229624.83	11
50	43575.48	90006.54	48413.68	206553.18	111103.04	229486.85	10
51	43601.66	89993.86	48449.59	206400.08	111118.69	229349.06	9
52	43627.84	89981.17	48485.52	206247.16	111134.36	229211.45	8
53	43654.01	89968.48	48521.45	206094.42	111150.04	229074.03	7
54	43680.18	89955.78	48557.39	205941.87	111165.73	228936.79	6
55	43706.34	89943.07	48593.34	205789.50	111181.44	228799.74	5
56	43732.50	89930.35	48629.31	205637.32	111197.16	228662.86	4
57	43758.66	89917.62	48665.28	205485.31	111212.90	228526.18	3
58	43784.82	89904.89	48701.26	205333.49	111228.65	228389.67	2
59	43810.97	89892.15	48737.26	205181.84	111244.42	228253.34	1
60	43837.12	89879.40	48773.26	205030.38	111260.19	228117.20	0

26	Sinus		Tangens		Secans		
0	43837.12	89879.40	48773.26	205030.38	111260.19	228117.20	60
1	43863.26	89866.65	48809.27	204879.10	111275.98	227981.24	59
2	43889.40	89853.89	48845.30	204728.00	111291.79	227845.46	58
3	43915.53	89841.12	48881.33	204577.08	111307.61	227709.86	57
4	43941.66	89828.34	48917.37	204426.34	111323.45	227574.45	56
5	43967.79	89815.55	48953.43	204275.78	111339.30	227439.21	55
6	43993.92	89802.76	48989.49	204125.40	111355.16	227304.15	54
7	44020.04	89789.96	49025.57	203975.19	111371.03	227169.27	53
8	44046.16	89777.15	49061.66	203825.17	111386.92	227034.57	52
9	44072.27	89764.33	49097.75	203675.32	111402.82	226900.05	51
10	44098.38	89751.51	49133.86	203525.65	111418.74	226765.71	50
11	44124.48	89738.68	49169.97	203376.15	111434.67	226631.55	49
12	44150.58	89725.84	49206.10	203226.83	111450.62	226497.56	48
13	44176.68	89712.99	49242.24	203077.69	111466.58	226363.75	47
14	44202.78	89700.13	49278.38	202928.73	111482.55	226230.12	46
15	44228.87	89687.27	49314.54	202779.94	111498.54	226096.67	45
16	44254.96	89674.40	49350.71	202631.33	111514.54	225963.39	44
17	44281.04	89661.52	49386.89	202481.89	111530.56	225830.29	43
18	44307.12	89648.64	49423.08	202334.62	111546.59	225697.36	42
19	44333.20	89635.75	49459.28	202186.53	111562.63	225564.61	41
20	44359.27	89622.85	49495.49	202038.62	111578.69	225432.04	40
21	44385.34	89609.94	49531.71	201890.88	111594.76	225299.64	39
22	44411.40	89597.03	49567.94	201743.31	111610.84	225167.41	38
23	44437.46	89584.11	49604.18	201595.92	111626.94	225035.36	37
24	44463.52	89571.18	49640.43	201448.69	111643.06	224903.48	36
25	44489.57	89558.24	49676.69	201301.64	111659.19	224771.78	35
26	44515.62	89545.29	49712.97	201154.77	111675.33	224640.24	34
27	44541.67	89532.34	49749.25	201008.06	111691.49	224508.89	33
28	44567.71	89519.38	49785.54	200861.53	111707.66	224377.70	32
29	44593.75	89506.41	49821.85	200715.16	111723.84	224246.69	31
30	44619.78	89493.45	49858.16	200568.97	111740.04	224115.84	30
31	44645.81	89480.45	49894.49	200422.95	111756.25	223985.17	29
32	44671.84	89467.46	49930.82	200277.10	111772.48	223854.67	28
33	44697.86	89454.46	49967.17	200131.42	111788.72	223724.35	27
34	44723.88	89441.45	50003.52	199985.90	111804.98	223594.19	26
35	44749.90	89428.44	50039.89	199840.56	111821.25	223464.20	25
36	44775.91	89415.42	50076.27	199695.39	111837.53	223334.38	24
37	44801.92	89402.39	50112.66	199550.38	111853.83	223204.74	23
38	44827.92	89389.36	50149.06	199405.54	111870.14	223075.26	22
39	44853.92	89376.32	50185.47	199260.87	111886.47	222945.95	21
40	44879.92	89363.27	50221.89	199116.37	111902.81	222816.81	20
41	44905.91	89350.21	50258.32	198972.04	111919.16	222687.83	19
42	44931.90	89337.14	50294.76	198827.87	111935.53	222559.03	18
43	44957.89	89324.06	50331.21	198683.87	111951.91	222430.39	17
44	44983.87	89310.98	50367.67	198540.03	111968.31	222301.92	16
45	45009.85	89297.89	50404.15	198396.36	111984.72	222173.62	15
46	45035.82	89284.79	50440.63	198252.86	112001.15	222045.48	14
47	45061.79	89271.69	50477.13	198109.52	112017.59	221917.51	13
48	45087.76	89258.58	50513.63	197966.35	112034.05	221789.71	12
49	45113.72	89245.46	50550.15	197823.34	112050.52	221662.07	11
50	45139.68	89232.35	50586.68	197680.50	112067.00	221534.60	10
51	45165.63	89219.20	50623.22	197537.82	112083.50	221407.30	9
52	45191.58	89206.06	50659.77	197395.31	112100.01	221280.16	8
53	45217.53	89192.91	50696.33	197252.96	112116.53	221153.18	7
54	45243.47	89179.75	50732.90	197110.77	112133.07	221026.37	6
55	45269.41	89166.59	50769.48	196968.74	112149.63	220899.72	5
56	45295.35	89153.42	50806.07	196826.88	112166.20	220773.23	4
57	45321.28	89140.24	50842.67	196685.18	112182.78	220646.91	3
58	45347.21	89127.05	50879.28	196543.64	112199.38	220520.75	2
59	45373.13	89113.85	50915.91	196402.27	112216.00	220394.76	1
60	45399.05	89100.65	50952.54	196261.05	112232.62	220268.93	0

27	Sinus		Tangens		Secans		
0	45399.05	89100.65	50952.54	196261.05	112232.62	220268.93	60
1	45424.97	89087.44	50989.19	196120.00	112249.26	220143.26	59
2	45450.88	89074.22	51025.85	195979.10	112265.92	220017.75	58
3	45476.79	89061.00	51062.52	195838.87	112282.59	219892.40	57
4	45502.69	89047.77	51099.19	195697.80	112299.28	219767.21	56
5	45528.59	89034.53	51135.88	195557.39	112315.98	219642.19	55
6	45554.49	89021.28	51172.59	195417.13	112332.69	219517.33	54
7	45580.38	89008.02	51209.30	195277.04	112349.42	219392.62	53
8	45606.27	88994.76	51246.02	195137.11	112366.16	219268.08	52
9	45632.16	88981.49	51282.75	194997.33	112382.92	219143.70	51
10	45658.04	88968.21	51319.50	194857.71	112399.69	219019.47	50
11	45683.92	88954.93	51356.25	194718.26	112416.48	218895.41	49
12	45709.79	88941.64	51393.02	194578.96	112433.28	218771.50	48
13	45735.66	88928.34	51429.80	194439.81	112450.10	218647.75	47
14	45761.53	88915.03	51466.58	194300.83	112466.93	218524.17	46
15	45787.39	88901.72	51503.38	194162.00	112483.77	218400.74	45
16	45813.25	88888.39	51540.19	194023.33	112500.63	218277.46	44
17	45839.10	88875.06	51577.02	193884.81	112517.50	218154.35	43
18	45864.95	88861.72	51613.85	193746.45	112534.39	218031.39	42
19	45890.80	88848.37	51650.69	193608.25	112551.29	217908.59	41
20	45916.64	88835.02	51687.55	193470.20	112568.21	217785.94	40
21	45942.48	88821.66	51724.41	193332.31	112585.14	217663.46	39
22	45968.32	88808.29	51761.29	193194.57	112602.09	217541.12	38
23	45094.15	88794.92	51798.18	193056.98	112619.05	217418.95	37
24	46019.98	88781.54	51835.08	192919.56	112636.03	217296.93	36
25	46045.80	88768.15	51871.99	192782.28	112653.02	217175.06	35
26	46071.62	88754.75	51908.91	192645.16	112670.03	217053.35	34
27	46097.44	88741.34	51945.84	192508.19	112687.05	216931.80	33
28	46123.25	88727.93	51982.78	192371.38	112704.08	216810.40	32
29	46149.06	88714.51	52019.74	192234.72	112721.13	216689.15	31
30	46174.86	88701.08	52056.70	192098.21	112738.19	216568.06	30
31	46200.66	88687.64	52093.68	191961.86	112755.27	216447.12	29
32	46226.46	88674.20	52130.67	191825.65	112772.37	216326.33	28
33	46252.25	88660.75	52167.67	191689.60	112789.48	216205.70	27
34	46278.04	88647.29	52204.68	191553.70	112806.60	216085.22	26
35	46303.82	88633.83	52241.70	191417.95	112823.74	215964.89	25
36	46329.60	88620.36	52278.74	191282.36	112840.89	215844.71	24
37	46355.38	88606.88	52315.78	191146.91	112858.06	215724.69	23
38	46381.15	88593.39	52352.84	191011.62	112875.24	215604.82	22
39	46406.92	88579.89	52389.90	190876.47	112892.44	215485.10	21
40	46432.69	88566.39	52426.98	190741.47	112909.65	215365.53	20
41	46458.45	88552.88	52464.07	190606.63	112926.88	215246.11	19
42	46484.21	88539.36	52501.17	190471.93	112944.12	215126.84	18
43	46509.96	88525.83	52538.29	190337.38	112961.37	215007.72	17
44	46535.71	88512.30	52575.41	190202.99	112978.64	214888.75	16
45	46561.45	88498.76	52612.54	190068.74	112995.93	214769.93	15
46	46587.19	88485.21	52649.69	189934.64	113013.23	214651.27	14
47	46612.93	88471.66	52686.85	189800.68	113030.55	214532.75	13
48	46638.66	88458.10	52724.02	189666.88	113047.88	214414.37	12
49	46664.39	88444.53	52761.20	189533.22	113065.22	214296.15	11
50	46690.12	88430.95	52798.39	189399.71	113082.58	214178.08	10
51	46715.84	88417.36	52835.59	189266.34	113099.96	214060.15	9
52	46741.56	88403.77	52872.81	189133.13	113117.35	213942.38	8
53	46767.27	88390.17	52910.04	189000.06	113134.75	213824.75	7
54	46792.98	88376.56	52947.27	188867.13	113152.17	213707.26	6
55	46818.69	88362.94	52984.52	188734.36	113169.61	213589.93	5
56	46844.39	88349.32	53021.78	188601.72	113187.06	213472.74	4
57	46870.09	88335.69	53059.06	188469.24	113204.52	213355.70	3
58	46895.78	88322.05	53096.34	188336.90	113222.00	213238.80	2
59	46921.47	88308.41	53133.64	188204.70	113239.50	213122.05	1
60	46947.16	88294.76	53170.94	188072.65	113257.01	213005.45	0

28	Sinus		Tangens		Secans		
0	46947.16	88294.76	53170.94	188072.65	113257.01	213005.45	60
1	46972.84	88281.10	53208.26	187940.74	113274.58	212888.99	59
2	46998.52	88267.43	53245.59	187808.98	113292.07	212772.67	58
3	47024.19	88253.75	53282.93	187677.36	113309.62	212656.51	57
4	47049.86	88240.07	53320.29	187545.88	113327.19	212540.48	56
5	47075.53	88226.38	53357.65	187414.55	113344.78	212424.60	55
6	47101.19	88212.68	53395.03	187283.36	113362.38	212308.87	54
7	47126.85	88198.98	53432.42	187152.31	113379.99	212193.28	53
8	47152.50	88185.27	53469.82	187021.41	113397.62	212077.83	52
9	47178.15	88171.55	53507.23	186890.64	113415.27	211962.53	51
10	47203.80	88157.82	53544.65	186760.03	113432.93	211847.37	50
11	47229.44	88144.09	53582.08	186629.55	113450.60	211732.35	49
12	47255.08	88130.35	53619.53	186499.21	113468.29	211617.48	48
13	47280.71	88116.60	53656.99	186369.02	113486.00	211502.74	47
14	47306.34	88102.84	53694.46	186238.96	113503.72	211388.15	46
15	47331.97	88089.07	53731.94	186109.05	113521.46	211273.71	45
16	47357.59	88075.30	53769.43	185979.28	113539.21	211159.40	44
17	47383.21	88051.52	53806.94	185849.65	113556.98	211045.23	43
18	47408.82	88047.73	53844.45	185720.15	113574.76	210931.21	42
19	47434.43	88033.94	53881.98	185590.80	113592.55	210817.33	41
20	47460.04	88020.14	53919.52	185461.59	113610.36	210703.59	40
21	47485.64	88006.33	53957.07	185332.52	113628.19	210589.98	39
22	47511.24	87992.51	53994.64	185203.58	113646.03	210476.52	38
23	47536.83	87978.69	54032.21	185074.79	113663.89	210363.20	37
24	47562.42	87964.86	54069.80	184946.13	113681.76	210250.02	36
25	47588.01	87951.02	54107.40	184817.61	113699.65	210136.98	35
26	47613.59	87937.17	54145.01	184689.23	113717.55	210024.08	34
27	47639.17	87923.32	54182.63	184560.99	113735.47	209911.31	33
28	47664.74	87909.46	54220.27	184432.89	113753.40	209798.69	32
29	47690.31	87895.59	54257.91	184304.92	113771.35	209686.20	31
30	47715.88	87881.71	54295.57	184177.09	113789.32	209573.85	30
31	47741.44	87867.83	54333.24	184049.39	113807.30	209461.64	29
32	47767.00	87853.94	54370.92	183921.84	113825.29	209349.57	28
33	47792.55	87840.04	54408.62	183794.42	113843.30	209237.64	27
34	47818.10	87826.13	54446.32	183667.13	113861.33	209125.84	26
35	47843.64	87812.22	54484.04	183539.99	113879.37	209014.18	25
36	47869.18	87798.30	54521.77	183412.97	113897.43	208902.65	24
37	47894.72	87784.37	54559.51	183286.10	113915.50	208791.27	23
38	47920.26	87770.43	54597.26	183159.36	113933.59	208680.02	22
39	47945.79	87756.49	54635.03	183032.75	113951.69	208568.90	21
40	47971.31	87742.54	54672.81	182906.28	113969.81	208457.92	20
41	47996.83	87728.58	54710.60	182779.94	113987.94	208347.08	19
42	48022.35	87714.61	54748.40	182653.74	114006.09	208236.37	18
43	48047.86	87700.64	54786.21	182527.67	114024.25	208125.80	17
44	48073.37	87686.66	54824.04	182401.73	114042.43	208015.36	16
45	48098.88	87672.67	54861.88	182275.93	114060.62	207905.06	15
46	48124.38	87658.68	54899.73	182150.26	114078.83	207794.89	14
47	48149.88	87644.68	54937.59	182024.73	114097.06	207684.86	13
48	48175.37	87630.67	54975.46	181899.32	114115.30	207574.96	12
49	48200.86	87616.65	55013.35	181774.05	114133.56	207465.19	11
50	48226.34	87602.62	55051.25	181648.92	114151.83	207355.56	10
51	48251.82	87588.59	55089.16	181523.91	114170.12	207246.06	9
52	48277.30	87574.55	55127.08	181399.04	114188.42	207136.70	8
53	48302.77	87560.50	55165.02	181274.30	114206.74	207027.46	7
54	48328.24	87546.45	55202.97	181149.69	114225.07	206918.36	6
55	48353.70	87532.39	55240.93	181025.21	114243.42	206809.40	5
56	48379.16	87518.32	55278.90	180900.86	114261.79	206700.56	4
57	48404.62	87504.24	55316.88	180776.64	114280.17	206591.86	3
58	48430.07	87490.16	55354.88	180652.56	114298.57	206483.28	2
59	48455.52	87476.07	55392.88	180528.60	114316.98	206374.84	1
60	48480.96	87461.97	55430.90	180404.78	114335.41	206266.53	0

29	Sinus		Tangens		Secans		
0	48480.96	87461.97	55430.90	180404.78	114335.41	206266.53	60
1	48506.40	87447.86	55468.94	180281.08	114353.85	206158.36	59
2	48531.84	87433.75	55506.98	180157.51	114372.31	206050.31	58
3	48557.27	87419.63	55545.04	180034.08	114390.78	205942.39	57
4	48582.70	87405.50	55583.11	179910.77	114409.27	205834.60	56
5	48608.12	87391.36	55621.19	179787.59	114427.78	205726.95	55
6	48633.54	87377.22	55659.29	179664.54	114446.30	205619.42	54
7	48658.95	87363.07	55697.39	179541.62	114464.84	205512.03	53
8	48684.36	87348.91	55735.51	179418.83	114483.39	205404.76	52
9	48709.77	87334.75	55773.64	179296.16	114501.96	205297.62	51
10	48735.17	87320.58	55811.79	179173.62	114520.55	205190.61	50
11	48760.57	87306.40	55849.94	179051.21	114539.15	205083.73	49
12	48785.97	87292.21	55888.11	178928.93	114557.76	204976.98	48
13	48811.36	87278.01	55926.29	178806.78	114576.39	204870.36	47
14	48836.74	87263.81	55964.48	178684.75	114595.04	204763.86	46
15	48862.12	87249.60	56002.69	178562.85	114613.70	204657.50	45
16	48887.50	87235.38	56040.91	178441.07	114632.38	204551.26	44
17	48912.87	87221.16	56079.14	178319.43	114651.08	204445.15	43
18	48938.24	87206.93	56117.38	178197.90	114669.79	204339.16	42
19	48963.61	87192.69	56155.64	178076.51	114688.52	204233.30	41
20	48988.97	87178.44	56193.91	177955.24	114707.26	204127.57	40
21	49014.33	87164.19	56232.19	177834.09	114726.02	204021.97	39
22	49039.68	87149.93	56270.48	177713.07	114744.79	203916.49	38
23	49065.03	87135.66	56308.79	177592.18	114763.58	203851.14	37
24	49090.37	87121.38	56347.10	177471.41	114782.39	203705.92	36
25	49115.71	87107.10	56385.43	177350.76	114801.21	203600.82	35
26	49141.05	87092.81	56423.78	177230.24	114820.05	203495.85	34
27	49166.38	87078.51	56462.13	177109.85	114838.90	203391.00	33
28	49191.71	87064.20	56500.50	176989.58	114857.77	203286.27	32
29	49217.04	87049.89	56538.88	176869.43	114876.65	203181.68	31
30	49242.36	87035.57	56577.28	176749.40	114895.55	203077.20	30
31	49267.67	87021.24	56615.68	176629.50	114914.47	202972.86	29
32	49292.98	87006.90	56654.10	176509.72	114933.40	202868.63	28
33	49318.29	86992.56	56692.53	176390.07	114952.35	202764.53	27
34	49343.59	86978.21	56730.98	176270.53	114971.32	202660.56	26
35	49368.89	86963.85	56769.44	176151.12	114990.30	202556.70	25
36	49394.19	86949.49	56807.91	176031.83	115009.30	202452.97	24
37	49419.48	86935.12	56846.39	175912.67	115028.31	202349.37	23
38	49444.77	86920.74	56884.88	175793.62	115047.34	202245.89	22
39	49470.05	86906.35	56923.39	175674.70	115066.38	202142.53	21
40	49495.33	86891.96	56961.91	175555.90	115085.44	201039.29	20
41	49520.60	86877.56	57000.45	175437.22	115104.52	201936.17	19
42	49545.87	86863.15	57038.99	175318.66	115123.61	201833.18	18
43	49571.13	86848.73	57077.55	175200.23	115141.72	201730.31	17
44	49596.39	86834.31	57116.12	175081.91	115161.85	201627.56	16
45	49621.65	86819.88	57154.71	174963.71	115180.99	201524.94	15
46	49646.90	86805.44	57193.31	174845.64	115200.15	201422.43	14
47	49672.15	86791.00	57231.92	174727.68	115219.32	201320.05	13
48	49697.40	86776.55	57270.54	174609.84	115238.51	201217.79	12
49	49722.64	86762.09	57309.18	174492.13	115257.72	201115.64	11
50	49747.87	86747.62	57347.83	174374.53	115276.94	201013.62	10
51	49773.10	86733.14	57386.49	174257.05	115296.18	200911.72	9
52	49798.33	86718.66	57425.16	174139.69	115315.43	200809.94	8
53	49823.55	86704.17	57463.85	174022.45	115334.70	200708.28	7
54	49848.77	86689.67	57502.55	173905.33	115353.99	200606.74	6
55	49873.99	86675.17	57541.26	173788.33	115373.29	200505.32	5
56	49899.20	86660.66	57579.99	173671.44	115392.61	200404.02	4
57	49924.41	86646.14	57618.73	173554.68	115411.95	200302.83	3
58	49949.61	86631.61	57657.48	173438.03	115431.30	200201.77	2
59	49974.81	86617.08	57696.25	173321.49	115450.67	200100.83	1
60	50000.00	86602.54	57735.03	173205.08	115470.05	200000.00	0

30	Sinus		Tangens		Secans		
0	50000.00	86602.54	57735.03	173205.08	115470.05	200000.00	60
1	50025.19	86587.99	57773.82	173088.78	115489.45	199899.29	59
2	50050.38	86573.43	57812.62	172972.60	115508.87	199798.70	58
3	50075.56	86558.87	57851.44	172856.54	115528.30	199698.23	57
4	50100.74	86544.30	57890.27	172740.60	115547.75	199597.88	56
5	50125.91	86525.72	57929.11	172624.77	115567.22	199497.64	55
6	50151.08	86515.14	57967.97	172509.05	115586.70	199397.53	54
7	50176.24	86500.55	58006.84	172393.45	115606.20	199297.52	53
8	50201.40	86485.95	58045.73	172277.97	115625.72	199197.64	52
9	50226.55	86471.34	58084.62	172162.61	115645.25	199097.87	51
10	50251.70	86456.73	58123.53	172047.36	115664.80	198998.22	50
11	50276.85	86442.11	58162.45	171932.22	115684.36	198898.69	49
12	50301.99	86427.48	58201.39	171817.20	115703.94	198799.27	48
13	50327.13	86412.84	58240.34	171702.30	115723.54	198699.97	47
14	50352.27	86398.20	58279.30	171587.51	115743.15	198600.80	46
15	50377.40	86383.55	58318.28	171472.83	115762.78	198501.72	45
16	50402.53	86368.89	58357.27	171358.27	115782.43	198402.76	44
17	50427.65	86354.23	58396.27	171243.82	115802.09	198303.93	43
18	50452.77	86339.56	58435.28	171129.49	115821.77	198205.20	42
19	50477.88	86324.88	58474.31	171015.27	115841.47	198106.59	41
20	50502.99	86310.19	58513.35	170901.16	115861.18	198008.10	40
21	50528.09	86295.49	58552.41	170787.17	115880.91	197909.72	39
22	50553.19	86280.79	58591.48	170673.29	115900.65	197811.46	38
23	50578.28	86266.08	58630.56	170559.53	115920.41	197713.31	37
24	50603.37	86251.36	58669.65	170445.87	115940.19	197615.27	36
25	50628.46	86236.64	58708.76	170332.33	115959.99	197517.35	35
26	50653.55	86221.91	58747.88	170218.90	115979.80	197419.54	34
27	50678.63	86107.17	58787.02	170105.59	115999.63	197321.85	33
28	50703.70	86192.43	58826.17	169992.38	116019.47	197224.26	32
29	50728.77	86177.68	58865.33	169879.29	116039.33	197126.80	31
30	50753.84	86162.92	58904.50	169766.31	116059.21	197029.44	30
31	50778.90	86148.15	58943.69	169653.44	116079.11	196932.20	29
32	50803.96	86133.37	58982.89	169540.69	116099.02	196835.07	28
33	50829.01	86118.59	59022.11	169428.04	116118.95	196738.05	27
34	50854.06	86103.80	59061.34	169315.50	116138.89	196641.14	26
35	50879.10	86089.00	59100.58	169203.08	116158.85	196544.34	25
36	50904.14	86074.20	59139.83	169090.77	116178.83	196447.67	24
37	50929.18	86059.39	59179.10	168978.56	116198.82	196351.10	23
38	50954.21	86044.57	59218.39	168866.47	116218.83	196254.64	22
39	50979.24	86029.74	59257.68	168754.49	116238.86	196158.29	21
40	51004.26	86014.91	59296.99	168642.61	116258.91	196062.06	20
41	51029.28	86000.07	59336.32	168530.85	116278.97	195965.93	19
42	51054.29	85985.22	59375.66	168419.19	116299.05	195869.92	18
43	51079.30	85970.37	59415.01	168307.65	116319.14	195774.01	17
44	51104.31	85955.51	59454.37	168196.21	116339.25	195678.22	16
45	51129.31	85940.64	59493.75	168084.89	116359.38	195582.54	15
46	51154.31	85925.76	59533.14	167973.67	116379.53	195486.97	14
47	51179.30	85910.88	59572.54	167862.56	116399.69	195391.50	13
48	51204.29	85895.99	59611.96	167751.56	116419.87	195296.15	12
49	51229.27	85881.09	59651.40	167640.67	116440.07	195200.91	11
50	51254.25	85866.18	59690.84	167529.88	116460.28	195105.77	10
51	51279.22	85851.27	59730.30	167419.21	116480.51	195010.75	9
52	51304.19	85836.35	59769.78	167308.64	116500.76	194915.83	8
53	51329.16	85821.42	59809.27	167198.18	116521.02	194821.02	7
54	51354.12	85806.49	59848.77	167087.82	116541.30	194726.32	6
55	51379.08	85791.55	59888.28	166977.58	116561.60	194631.73	5
56	51404.04	85776.60	59927.81	166867.44	116581.91	194537.25	4
57	51428.99	85761.64	59967.35	166757.41	116602.24	194442.88	3
58	51453.93	85746.68	60006.91	166647.48	116622.59	194348.61	2
59	51478.87	85731.71	60046.48	166537.66	116642.96	194254.45	1
60	51503.81	85716.73	60086.06	166427.95	116663.34	194160.40	0

31	Sinus		Tangens		Secans		
0	51503.81	85716.73	60086.06	166427.95	116663.34	194160.40	60
1	51528.74	85701.74	60125.66	166318.34	116683.74	194066.46	59
2	51553.67	85686.75	60165.27	166208.84	116704.16	193972.62	58
3	51578.59	85671.75	60204.90	166099.45	116724.59	193878.89	57
4	51603.51	85656.74	60244.54	165990.16	116745.04	193785.27	56
5	51628.42	85641.73	60284.19	165880.97	116765.51	193691.76	55
6	51653.33	85626.71	60323.86	165771.89	116785.90	193598.35	54
7	51678.24	85611.68	60363.54	165662.92	116806.49	193505.05	53
8	51703.14	85596.64	60403.23	165554.05	116827.01	193411.85	52
9	51728.04	85581.60	60442.94	165445.29	116847.55	193318.76	51
10	51752.93	85566.55	60482.66	165336.63	116868.10	193225.78	50
11	51777.82	85551.49	60522.40	165228.08	116888.67	193132.90	49
12	51802.70	85536.42	60562.15	165119.63	116909.26	193040.13	48
13	51827.58	85521.35	60601.92	165011.28	116929.86	192947.46	47
14	51852.46	85506.27	60641.70	164903.04	116950.48	192854.90	46
15	51877.33	85491.18	60681.49	164794.90	119972.22	192762.44	45
16	51902.19	85476.09	60721.30	164686.86	116991.78	192670.09	44
17	51927.05	85460.99	60761.12	164578.93	117012.45	192577.84	43
18	51951.91	85445.88	60800.95	164471.11	117033.14	192485.70	42
19	51976.76	85430.76	60840.80	164363.38	117053.85	192393.66	41
20	52001.61	85415.64	60880.67	164255.76	117074.57	192301.73	40
21	52026.46	85400.51	60920.54	164148.24	117095.31	192209.90	39
22	52051.30	85385.37	60960.43	164040.82	117116.07	192118.17	38
23	52076.13	85370.23	61000.34	163933.51	117136.85	192026.55	37
24	52100.96	85355.08	61040.26	163826.30	117157.64	191935.03	36
25	52125.79	85339.92	61080.19	163719.19	117178.45	191843.62	35
26	52150.61	85324.75	61120.14	163612.18	117199.28	191752.30	34
27	52175.43	85309.58	61160.11	163505.28	117220.13	191661.09	33
28	52200.24	85294.40	61200.08	163398.47	117240.99	191569.99	32
29	52225.05	85279.21	61240.07	163291.77	117261.87	191478.99	31
30	52249.86	85264.02	61280.08	163185.17	117282.77	191388.09	30
31	52274.66	85248.81	61320.10	163078.67	117303.69	191297.29	29
32	52299.45	85233.60	61360.13	162972.27	117324.62	191206.59	28
33	52324.24	85218.38	61400.18	162865.97	117345.57	191116.00	27
34	52349.03	85203.16	61440.24	162759.77	117366.54	191025.51	26
35	52373.81	85187.93	61480.32	162653.68	117387.52	190935.12	25
36	52398.59	85172.69	61520.41	162547.68	117408.52	190844.83	24
37	52423.36	85157.44	61560.52	162441.78	117429.54	190754.64	23
38	52448.13	85142.19	61600.64	162335.99	117450.58	190664.56	22
39	52472.90	85126.93	61640.77	162230.29	117471.64	190574.57	21
40	52497.66	85111.66	61680.92	162124.69	117492.71	190484.69	20
41	52522.41	85096.39	61721.08	162019.20	117513.80	190394.91	19
42	52547.16	85081.11	61761.26	161913.80	117534.91	190305.22	18
43	52571.91	85065.82	61801.45	161808.50	117556.03	190215.64	17
44	52596.65	85050.52	61841.66	161703.30	117577.17	190126.16	16
45	52621.39	85035.22	61881.88	161598.20	117598.33	190036.78	15
46	52646.12	85019.91	61922.11	161493.20	117619.51	189947.50	14
47	52670.85	85004.59	61962.36	161388.29	117640.70	189858.32	13
48	52695.58	84989.27	62002.63	161283.49	117661.91	189769.24	12
49	52720.30	84973.94	62042.91	161178.78	117683.14	189680.26	11
50	52745.02	84958.60	62083.20	161074.17	117704.39	189591.38	10
51	52769.73	84943.25	62123.51	160969.66	117725.66	189502.59	9
52	52794.44	84927.90	62163.83	160865.25	117746.94	189413.91	8
53	52819.14	84912.54	62204.17	160760.94	117768.24	189325.32	7
54	52843.84	84897.17	62244.52	160656.72	117789.56	189236.84	6
55	52868.53	84881.79	62284.88	160552.60	117810.90	189148.45	5
56	52893.22	84866.41	62325.26	160448.58	117832.25	189060.16	4
57	52917.90	84851.02	62365.66	160344.65	117853.62	188971.97	3
58	52942.58	84835.62	62406.07	160240.82	117875.01	188883.88	2
59	52967.26	84820.22	62446.50	160137.09	117896.42	188795.89	1
60	52991.93	83804.81	62486.94	160033.45	117917.84	188707.99	0
							58

32	Sinus		Tangens		Secans		
0	52991.93	84804.81	62486.94	160033.45	117917.84	188707.99	60
1	53016.59	84789.39	62527.39	159929.91	117939.28	188610.19	59
2	53041.25	84773.96	62567.86	159826.47	117960.74	188532.49	58
3	53065.91	84758.53	62608.34	159723.12	117982.22	188444.89	57
4	53090.56	84743.09	62648.84	159619.87	118003.72	188357.38	56
5	53115.21	84727.64	62689.35	159516.72	118025.23	188269.97	55
6	53139.86	84712.19	62729.88	159413.66	118046.76	188182.66	54
7	53164.50	84696.73	62770.42	159310.70	118068.31	188095.45	53
8	53189.13	84681.26	62810.98	159207.83	118089.88	188008.33	52
9	53213.76	84665.78	62851.56	159105.05	118111.47	187921.31	51
10	53238.39	84650.30	62892.15	159002.38	118133.07	187834.38	50
11	53263.01	84634.81	61932.75	158899.79	118154.69	187747.55	49
12	53287.63	84619.31	62973.36	158797.30	118176.33	187660.82	48
13	53312.24	84603.81	63013.99	158694.91	118197.99	187574.18	47
14	53336.85	84588.30	63054.64	158592.61	118219.66	187487.64	46
15	53361.45	84572.78	63095.30	158490.41	118241.35	187401.20	45
16	53386.05	84557.25	63135.98	158388.30	118263.06	187314.85	44
17	53410.64	84541.72	63176.67	158286.28	118284.79	187228.59	43
18	53435.23	84526.18	63217.38	158184.36	118306.54	187142.43	42
19	53459.82	84510.63	63258.10	158082.53	118328.30	187056.37	41
20	53484.40	84495.08	63298.83	157980.79	118350.08	186970.40	40
21	53508.98	84479.52	63339.58	157879.15	118371.88	186884.53	39
22	53533.55	84463.95	63380.35	157777.60	118393.70	186798.75	38
23	53558.12	84448.37	63421.13	157676.15	118415.54	186713.06	37
24	53582.68	84432.79	63461.93	157574.79	118437.40	186627.47	36
25	53607.24	84417.20	63502.74	157473.52	118459.27	186541.97	35
26	53631.79	84401.60	63543.57	157372.34	118481.16	186456.57	34
27	53656.34	84386.00	63584.41	157271.26	118503.07	186371.26	33
28	53680.88	84370.39	63625.27	157170.26	118525.00	186286.05	32
29	53705.42	84354.77	63666.14	157069.36	118546.94	186200.93	31
30	53729.96	84339.14	63707.03	156968.56	118568.91	186115.90	30
31	53754.49	84323.51	63747.93	156867.84	118590.89	186030.96	29
32	53779.02	84307.87	63788.85	156767.22	118612.89	185946.12	28
33	53803.54	84292.22	63829.78	156666.69	118634.91	185861.38	27
34	53828.06	84276.57	63870.73	156566.25	118656.95	185776.72	26
35	53852.57	84260.91	63911.69	156465.90	118679.00	185692.16	25
36	53877.08	84245.24	63952.67	156365.64	118701.07	185607.69	24
37	53901.58	84229.56	63993.66	156265.48	118723.16	185523.31	23
38	53926.08	84213.88	64034.67	156165.40	118745.27	185439.03	22
39	53950.58	84198.19	64075.69	156065.42	118767.40	185354.83	21
40	53975.07	84182.49	64116.73	155965.52	118789.55	185270.73	20
41	53999.55	84166.79	64157.79	155865.72	118811.71	185186.72	19
42	54024.03	84151.08	64198.86	155766.01	118833.89	185102.81	18
43	54048.51	84135.36	64239.95	155666.39	118856.09	185018.98	17
44	54072.98	84119.63	64281.05	155566.85	118878.31	184935.25	16
45	54097.45	84103.90	64322.16	155467.41	118900.55	184851.61	15
46	54121.91	84088.16	64363.29	155368.06	118922.81	184768.05	14
47	54146.37	84072.41	64404.44	155268.80	118945.08	184684.59	13
48	54170.82	84056.66	64445.60	155169.63	118967.37	184601.23	12
49	54195.27	84040.90	64486.78	155070.54	118989.68	184517.95	11
50	54219.71	84025.13	64527.97	154971.55	119012.01	184434.76	10
51	54244.15	84009.35	64569.18	154872.64	119034.36	184351.66	9
52	54268.59	83993.57	64610.41	154773.83	119056.73	184268.66	8
53	54293.02	83977.78	64651.65	154675.10	119079.12	184185.74	7
54	54317.44	83961.98	64692.90	154576.46	119101.52	184102.92	6
55	54341.86	83946.18	64734.17	154477.92	119123.94	184020.18	5
56	54366.28	83930.37	64775.46	154379.46	119146.38	183937.53	4
57	54390.69	83914.55	64816.76	154281.08	119268.84	183854.98	3
58	54415.10	83898.73	64858.08	154182.80	119191.32	183772.51	2
59	54439.50	83882.90	64899.41	154084.60	119213.82	183690.13	1
60	54463.90	83867.06	64940.76	153986.50	119236.33	183607.84	0

33	Sinus		Tangens		Secans		
0	54463.90	83867.06	64940.76	153986.50	119236.33	183607.84	60
1	54488.30	83851.21	64982.12	153888.48	119258.86	183525.64	59
2	54512.69	83835.36	65023.50	153790.55	119281.41	183443.53	58
3	54537.07	83819.50	65064.90	153692.70	119303.98	183361.51	57
4	54561.45	83803.63	65106.31	153594.94	119326.57	183279.58	56
5	54585.83	83787.75	65147.74	153497.27	119349.18	183197.74	55
6	54610.20	83771.87	65189.18	153399.69	119371.81	183115.99	54
7	54634.56	83755.98	65230.64	153302.20	119394.46	183034.32	53
8	54658.92	83740.08	65272.11	153204.79	119417.12	182952.74	52
9	54683.28	83724.18	65313.60	153107.47	119439.80	182871.25	51
10	54707.63	83708.27	65355.11	153010.23	119462.50	182789.85	50
11	54731.98	83692.35	65396.63	152913.08	119485.22	182708.54	49
12	54756.32	83676.43	65438.17	152816.02	119507.96	182627.31	48
13	54780.66	83660.50	65479.72	152719.04	119530.72	182546.17	47
14	54804.99	83644.56	65521.29	152622.15	119553.50	182465.12	46
15	54829.32	83628.61	65562.87	152525.35	119576.30	182384.16	45
16	54853.65	83612.66	65604.47	152428.63	119599.11	182303.28	44
17	54877.97	83596.70	65646.09	152332.00	119621.94	182222.49	43
18	54902.28	83580.73	65687.72	152235.45	119644.79	182141.79	42
19	54926.59	83564.76	65729.37	152138.99	119667.66	182061.18	41
20	54950.90	83548.78	65771.03	152042.61	119690.55	181980.65	40
21	54975.20	83532.79	65812.71	151946.32	119713.46	181900.21	39
22	54999.50	83516.80	65854.41	151850.12	119736.39	181819.85	38
23	55023.79	83500.80	65896.12	151754.00	119759.34	181739.58	37
24	55048.08	83484.79	65937.85	151657.96	119782.31	181659.40	36
25	55072.36	83468.77	65979.59	151562.01	119805.29	181579.30	35
26	55096.64	83452.75	66021.35	151466.14	119818.29	181499.29	34
27	55120.91	83436.72	66063.13	151370.36	119891.31	181419.37	33
28	55145.18	83420.68	66104.92	151274.66	119874.35	181339.53	32
29	55169.44	83404.63	66146.73	151129.05	119897.42	181259.77	31
30	55193.70	83388.58	66188.56	151083.52	119920.49	181180.10	30
31	55217.95	83372.52	66230.40	150988.07	119943.59	181100.52	29
32	55242.20	83356.45	66272.26	150892.71	119966.71	181021.01	28
33	55266.45	83340.38	66314.13	150797.43	119989.85	180942.61	27
34	55290.69	83324.30	66356.02	150702.24	120013.01	180862.28	26
35	55314.92	83308.21	66397.92	150607.13	120036.19	180783.04	25
36	55339.15	83292.12	66439.84	150512.10	120059.38	180703.88	24
37	55363.38	83276.02	66481.78	150417.16	120082.59	180624.81	23
38	55387.60	83259.91	66523.73	150322.30	120105.82	180545.82	22
39	55411.82	83243.80	66565.70	150227.52	120129.07	180466.91	21
40	55436.03	83227.68	66607.69	150132.82	120152.34	180388.09	20
41	55460.24	83211.55	66649.69	150038.20	120175.63	180309.35	19
42	55484.44	83195.41	66691.71	149943.67	120198.94	180230.70	18
43	55508.64	83179.27	66733.75	149849.22	120222.27	180152.13	17
44	55532.83	83163.12	66775.80	149754.86	120245.62	180073.65	16
45	55557.02	83146.96	66817.87	149660.58	120268.99	179995.25	15
46	55581.21	83130.79	66859.95	149566.38	120292.37	179916.93	14
47	55605.39	83114.62	66902.05	149472.26	120315.77	179838.69	13
48	55629.56	83098.44	66944.17	149378.22	120339.19	179760.54	12
49	55653.73	83082.26	66986.30	149284.26	120362.64	179682.47	11
50	55677.90	83066.07	67028.45	149190.38	120386.10	179604.48	10
51	55702.06	83049.87	67070.62	149096.59	120409.58	179526.58	9
52	55726.21	83033.66	67112.80	149002.88	120433.08	179448.76	8
53	55750.36	83017.45	67155.00	148909.25	120456.60	179372.02	7
54	55774.51	83001.23	67197.21	148815.70	120480.14	179293.37	6
55	55798.65	82985.00	67239.44	148722.23	120503.70	179215.80	5
56	55822.79	82968.76	67281.69	148628.84	120527.28	179138.31	4
57	55846.92	82952.52	67323.96	148535.53	120550.88	179060.90	3
58	55871.05	82936.27	67366.24	148442.30	120574.50	178983.58	2
59	55895.17	82920.02	67408.54	148349.16	120598.14	178906.33	1
60	55919.29	82903.76	67450.85	148256.10	120621.80	178829.16	0
							56

34	Sinus		Tangens		Secans		
0	55919.29	82903.76	67450.85	148256.10	120621.80	178829.16	60
1	55943.40	82887.49	67493.18	148163.11	120645.48	178752.08	59
2	55967.51	82871.21	67535.53	148070.21	120669.18	178675.08	58
3	55991.61	82854.93	67577.90	147977.38	120692.89	178598.17	57
4	56015.71	82838.64	67620.28	147884.63	120716.62	178521.33	56
5	56039.81	82822.34	67662.68	147791.97	120740.37	178444.57	55
6	56063.90	82806.03	67705.09	147699.38	120764.14	178367.90	54
7	56087.98	82789.72	67747.52	147606.88	120787.93	178291.31	53
8	56112.06	82773.40	67789.97	147514.45	120811.75	178214.79	52
9	56136.14	82757.07	67832.44	147422.10	120835.59	178138.36	51
10	56160.21	82740.74	67874.92	147329.83	120859.44	178062.01	50
11	56184.28	82724.40	67917.42	147237.64	120883.31	177985.74	49
12	56208.34	82708.05	67959.93	147145.53	120907.20	177909.55	48
13	56232.39	82691.70	68002.46	147053.50	120931.12	177833.43	47
14	56256.44	82675.34	68045.01	146961.55	120955.05	177757.40	46
15	56280.49	82658.97	68087.58	146869.67	120979.00	177681.45	45
16	56304.53	82642.60	68130.16	146777.87	121002.97	177605.58	44
17	56328.57	82626.22	68172.76	146686.16	121026.96	177529.79	43
18	56352.60	82609.83	68215.38	146594.52	121050.97	177454.08	42
19	56376.63	82593.43	68258.01	146502.96	121075.00	177378.45	41
20	56400.65	82577.03	68300.66	146411.47	121099.05	177302.90	40
21	56424.67	82560.62	68343.33	146320.07	121123.12	177227.43	39
22	56448.69	82544.20	68386.01	146228.74	121147.21	177152.04	38
23	56472.70	82527.78	68428.71	146137.49	121171.32	177076.73	37
24	56496.70	82511.35	68471.43	146046.32	121195.45	177001.49	36
25	56520.70	82494.91	68514.17	145955.22	121219.60	176926.33	35
26	56544.69	82478.47	68556.92	145864.20	121243.77	176851.25	34
27	56568.68	82462.02	68599.69	145773.26	121267.96	176776.25	33
28	56592.67	82445.56	68642.47	145682.40	121292.17	176701.33	32
29	56616.65	82429.09	68685.27	145591.61	121316.40	176626.49	31
30	56640.62	82412.62	68728.10	145500.90	121340.64	176551.73	30
31	56664.59	82396.14	68770.94	145410.27	121364.91	176477.04	29
32	56688.56	82379.65	68813.79	145319.71	121389.20	176402.43	28
33	56712.52	82363.16	68856.66	145229.23	121415.51	176327.91	27
34	56736.48	82346.66	68899.55	145138.83	121437.83	176253.45	26
35	56760.43	82330.15	68942.46	145048.50	121462.18	176179.08	25
36	56784.37	82313.64	68985.38	144958.25	121486.55	176104.78	24
37	56808.31	82297.12	69028.32	144868.08	121510.94	176030.56	23
38	56832.25	82280.59	69071.28	144777.98	121535.35	175956.41	22
39	56856.18	82264.05	69114.25	144687.96	121559.78	175882.36	21
40	56880.11	82247.51	69157.24	144598.01	121584.23	175808.37	20
41	56904.03	82230.96	69200.25	144508.14	121608.70	175734.45	19
42	56927.95	82214.40	69243.28	144418.34	121633.19	175660.63	18
43	56951.86	82197.84	69286.33	144328.62	121657.70	175586.87	17
44	56975.77	82181.27	69329.39	144238.97	121682.23	175513.19	16
45	56999.68	82164.69	69372.47	144149.40	121706.78	175439.59	15
46	57023.58	82148.11	69415.57	144059.91	121731.35	175366.07	14
47	57047.47	82131.52	69458.68	143970.49	121755.94	175292.62	13
48	57071.36	82114.92	69501.81	143881.14	121780.55	175219.24	12
49	57095.24	82098.31	69544.96	143791.87	121805.18	175145.94	11
50	57119.12	82081.70	69588.13	143702.68	121829.83	175072.73	10
51	57142.99	82065.08	69631.31	143613.56	121854.50	174999.58	9
52	57166.86	82048.46	69674.51	143524.51	121879.19	174926.51	8
53	57190.73	82031.83	69717.73	143435.54	121903.90	174853.52	7
54	57214.59	82015.19	69760.97	143346.64	121928.64	174780.60	6
55	57238.44	81998.54	69804.22	143257.81	121953.39	174707.96	5
56	57262.29	81981.89	69847.49	143169.06	121978.16	174634.99	4
57	57286.14	81965.23	69890.78	143080.39	122002.96	174562.30	3
58	57309.98	81948.56	69934.09	142991.78	122027.77	174489.69	2
59	57333.81	81931.89	69977.41	142903.26	122052.60	174417.15	1
60	57357.64	81915.21	70010.75	142814.80	122077.46	174344.68	0

35	Sinus		Tangens		Secans		
0	57357.64	81915.21	70020.75	142814.80	122077.46	174344.68	60
1	57381.47	81898.52	70064.11	142726.42	122102.33	174272.29	59
2	57405.29	81881.82	70107.49	142638.11	122127.23	174199.97	58
3	57429.11	81865.12	70150.89	142549.87	122152.15	174127.73	57
4	57452.92	81848.41	70194.30	142461.71	122177.08	174055.56	56
5	57476.72	81831.69	70237.73	142373.62	122202.04	173983.47	55
6	57500.52	81814.97	70281.18	142285.61	122227.02	173911.45	54
7	57524.32	81798.24	70324.65	142197.66	122252.01	173839.51	53
8	57548.11	81781.50	70368.13	142109.79	122277.03	173767.64	52
9	57571.90	81764.76	70411.63	142022.00	122302.07	173695.85	51
10	57595.68	81748.01	70455.15	141934.27	122327.13	173624.13	50
11	57619.46	81731.25	70498.69	141846.62	122352.21	173552.47	49
12	57643.23	81714.49	70542.24	141759.04	122377.32	173480.90	48
13	57667.00	81697.72	70585.81	141671.53	122402.44	173409.41	47
14	57690.76	81680.94	70629.40	141584.09	122427.58	173337.98	46
15	57714.52	81664.15	70673.01	141496.73	122452.74	173266.63	45
16	57738.27	81647.36	70716.64	141409.43	122477.93	173195.35	44
17	57762.02	81630.56	70760.29	141322.21	122503.13	173124.14	43
18	57785.76	81613.76	70803.95	141235.06	122528.36	173053.01	42
19	57809.50	81596.95	70847.63	141147.99	122553.61	172981.95	41
20	57833.23	81580.13	70891.33	141060.98	122578.87	172910.96	40
21	57856.96	81563.30	70935.05	140974.05	122604.16	172840.05	39
22	57880.68	81546.47	70978.78	140887.18	122629.47	172769.21	38
23	57904.40	81529.63	71022.53	140800.39	122654.80	172698.44	37
24	57928.12	81512.78	71066.30	140713.67	122680.15	172627.74	36
25	57951.83	81495.93	71110.09	140627.02	122705.52	172557.12	35
26	57975.53	81479.06	71153.90	140540.44	122730.91	172486.57	34
27	57999.23	81462.19	71197.73	140453.93	122756.33	172416.09	33
28	58022.92	81445.32	71241.57	140367.49	122781.76	172345.68	32
29	58046.61	81428.44	71285.43	140281.13	122807.21	172275.34	31
30	58070.30	81411.55	71329.31	140194.83	122832.69	172205.08	30
31	58093.98	81394.65	71373.21	140108.60	122858.19	172134.89	29
32	58117.65	81377.75	71417.13	140022.45	122883.71	172064.77	28
33	58141.32	81360.84	71461.06	139936.36	122909.25	171994.72	27
34	58164.98	81343.93	71505.01	139850.34	122934.81	171924.75	26
35	58188.64	81327.01	71548.98	139764.40	122960.39	171854.84	25
36	58212.30	81310.08	71592.97	139678.52	122985.99	171785.01	24
37	58235.95	81293.14	71636.98	139592.72	123011.61	171715.25	23
38	58259.59	81276.20	71681.01	139506.98	123037.25	171645.56	22
39	58283.23	81259.25	71725.05	139421.31	123062.92	171575.94	21
40	58306.87	81242.29	71769.11	139335.71	123088.61	171506.39	20
41	58330.50	81225.32	71813.19	139250.18	123114.32	171436.91	19
42	58354.12	81208.35	71857.29	139164.73	123140.05	171367.50	18
43	58377.74	81191.37	71901.41	139079.34	123165.80	171298.17	17
44	58401.36	81174.39	71945.55	138994.01	123191.57	171228.90	16
45	58424.97	81157.40	71989.70	138908.76	123217.36	171159.70	15
46	58448.57	81140.40	72033.87	138823.58	123243.17	171090.58	14
47	58472.17	81123.39	72078.06	138738.46	123269.00	171021.52	13
48	58495.77	81106.38	72122.27	138653.42	123294.86	170952.54	12
49	58519.36	81089.36	72166.50	138568.44	123320.74	170883.62	11
50	58542.94	81072.33	72210.75	138483.53	123346.64	170814.78	10
51	58566.52	81055.30	72255.02	138398.69	123372.56	170746.00	9
52	58590.10	81038.26	72299.31	138313.92	123398.50	170677.30	8
53	58613.67	81021.21	72343.61	138229.22	123424.46	170608.66	7
54	58637.24	81004.16	72387.93	138144.58	123450.44	170540.10	6
55	58660.80	80987.10	72432.27	138060.01	123476.45	170471.60	5
56	58684.35	80970.03	72476.63	137975.51	123502.48	170403.18	4
57	58707.90	80952.96	72521.01	137891.08	123528.52	170334.82	3
58	58731.45	80935.88	72565.41	137806.72	123554.59	170266.53	2
59	58754.99	80918.79	72609.83	137722.42	123580.68	170198.31	1
60	58778.53	80901.70	72654.26	137638.19	123606.80	170130.16	0

36	Sinus		Tangens		Secans		
0	58778.53	80901.70	72654.26	137638.19	123606.80	170130.16	60
1	58802.06	80884.60	72698.71	137554.03	123632.94	170062.08	59
2	58825.58	80867.49	72743.18	137469.94	123659.09	169994.07	58
3	58849.10	80850.37	72787.67	137385.91	123685.26	169926.12	57
4	58872.62	80833.25	72832.18	137301.95	123711.48	169858.25	56
5	58896.13	80816.12	72876.71	137218.05	123737.68	169790.44	55
6	58919.64	80798.99	72921.26	137134.23	123763.93	169722.71	54
7	58943.14	80781.85	72965.82	137050.47	123790.19	169655.04	53
8	58966.63	80764.70	73010.40	136966.78	123816.47	169587.43	52
9	58990.12	80747.54	73055.01	136883.15	123842.78	169519.90	51
10	59013.61	80730.38	73099.63	136799.59	123869.11	169452.44	50
11	59037.09	80713.21	73144.27	136716.10	123895.46	169385.04	49
12	59060.57	80696.03	73188.94	136632.67	123921.83	169317.71	48
13	59084.04	80678.85	73233.62	136549.31	123948.22	169250.45	47
14	59107.50	80661.66	73278.31	136466.02	123974.64	169183.26	46
15	59130.96	80644.46	73323.03	136382.79	124001.08	169116.13	45
16	59154.42	80627.26	73367.77	136299.63	124027.54	169049.07	44
17	59177.87	80610.05	73412.53	136216.53	124054.02	168982.08	43
18	59101.32	80592.83	73457.30	136133.50	124080.52	168915.16	42
19	59224.76	80575.60	73502.10	136050.54	124107.04	168848.30	41
20	59248.19	80558.37	73546.91	135967.64	124133.59	168781.51	40
21	59271.62	80541.13	73591.74	135884.81	124160.16	168714.79	39
22	59295.05	80523.89	73636.60	135802.04	124186.75	168648.14	38
23	59318.47	80506.64	73681.47	135719.34	124213.36	168581.55	37
24	59341.89	80489.38	73726.36	135636.70	124239.99	168515.03	36
25	59365.30	80472.11	73771.27	135554.13	124266.65	168448.57	35
26	59388.71	80454.84	73816.20	135471.62	124293.33	168382.18	34
27	59412.11	80437.56	73861.15	135389.18	124320.03	168315.86	33
28	59435.50	80420.28	73906.11	135306.80	124346.75	168249.61	32
29	59458.89	80402.99	73951.10	135224.49	124373.49	168183.42	31
30	59482.28	80385.69	73996.11	135142.24	124400.26	168117.30	30
31	59505.66	80368.38	74041.14	135060.06	124427.05	168051.24	29
32	59529.03	80351.07	74086.18	134977.94	124453.86	167985.25	28
33	59552.40	80333.75	74131.24	134895.89	124480.69	167919.33	27
34	59575.77	80316.42	74176.33	134813.90	124507.54	167853.47	26
35	59599.13	80299.09	74221.43	134731.97	124534.42	167787.68	25
36	59622.49	80281.75	74266.55	134650.11	124561.31	167721.95	24
37	59645.84	80264.40	74311.70	134568.32	124588.23	167656.29	23
38	59669.18	80247.05	74356.86	134486.58	124615.18	167590.70	22
39	59692.52	80229.69	74402.04	134404.92	124642.14	167525.17	21
40	59715.86	80212.32	74447.24	134323.31	124669.13	167459.70	20
41	59739.19	80194.94	74492.46	134241.77	124696.14	167394.30	19
42	59762.51	80177.56	74537.70	134160.29	124723.17	167328.97	18
43	59785.83	80160.17	74582.96	134078.88	124750.22	167263.70	17
44	59809.15	80142.78	74628.24	133997.53	124777.30	167198.50	16
45	59832.46	80125.38	74673.54	133916.24	124804.40	167133.36	15
46	59855.76	80107.97	74718.86	133835.02	124831.52	167068.28	14
47	59879.06	80090.56	74764.20	133753.86	124858.66	167003.28	13
48	59902.36	80073.14	74809.56	133672.76	124885.83	166938.33	12
49	59925.65	80055.71	74854.94	133591.72	124913.02	166873.45	11
50	59948.93	80038.27	74900.33	133510.75	124940.23	166808.64	10
51	59972.21	80020.83	74945.75	133429.84	124967.46	166743.89	9
52	59995.49	80003.38	74991.19	133349.00	124994.71	166679.20	8
53	60018.76	79985.93	75036.65	133268.22	125021.99	166614.58	7
54	60042.02	79968.47	75082.12	133187.49	125049.29	166550.02	6
55	60065.28	79951.00	75127.62	133106.84	125076.61	166485.52	5
56	60088.53	79933.52	75173.14	133026.24	125103.96	166421.09	4
57	60111.78	79916.04	75218.67	132945.71	125131.33	166356.73	3
58	60135.03	79898.55	75264.23	132865.24	125158.72	166292.43	2
59	60158.27	79881.05	75309.81	132784.83	125186.13	166228.19	1
60	60181.50	79863.55	75355.40	132704.48	125213.57	166164.01	0

37	Sinus		Tangens		Secans		52
0	60181.50	79863.55	75355.40	132704.48	125213.57	166164.01	60
1	60204.73	79846.04	75401.02	132624.20	125241.02	166099.90	59
2	60227.95	79828.52	75446.66	132543.97	125268.50	166035.85	58
3	60251.17	79811.00	75492.32	132463.81	125296.01	165971.87	57
4	60274.39	79793.47	75537.99	132383.71	125323.53	165907.95	56
5	60297.60	79775.93	75583.69	132303.68	125351.08	165844.09	55
6	60320.80	79758.39	75629.41	132223.70	125378.65	165780.30	54
7	60344.00	79740.84	75675.14	132143.79	125406.25	165716.57	53
8	60367.19	79723.28	75720.90	132063.93	125433.87	165652.90	52
9	60390.38	79705.72	75766.68	131984.14	125461.51	165589.29	51
10	60413.56	79688.15	75812.48	131904.41	125489.17	165525.75	50
11	60436.74	79670.57	75858.29	131824.74	125516.85	165462.27	49
12	60459.91	79652.99	75904.13	131745.13	125544.56	165398.85	48
13	60483.08	79635.40	75949.99	131665.59	125572.29	165335.50	47
14	60506.24	79617.80	75995.87	131586.10	125600.05	165272.21	46
15	60529.40	79600.20	76041.77	131506.68	125627.82	165208.98	45
16	60552.55	79582.59	76087.69	131427.31	125655.62	165145.81	44
17	60575.70	79564.97	76133.63	131348.01	125683.45	165082.70	43
18	60598.84	79547.35	76179.59	131268.76	125711.29	165019.66	42
19	60621.98	79529.72	76225.57	131189.58	125739.16	164956.68	41
20	60645.11	79512.08	76271.57	131110.46	125767.05	164893.76	40
21	60668.23	79494.43	76317.59	131031.40	125794.97	164830.90	39
22	60691.35	79476.78	76363.63	130052.39	125822.91	164768.11	38
23	60714.47	79459.12	76409.69	130873.45	125850.87	164705.37	37
24	60737.58	79441.46	76455.77	130794.57	125878.85	164642.70	36
25	60760.69	79423.79	76501.88	130715.75	125906.86	164580.09	35
26	60783.79	79406.11	76548.00	130636.99	125934.89	164517.54	34
27	60806.89	79388.43	76594.14	130558.28	125962.94	164455.06	33
28	60829.98	79370.74	76640.31	130479.64	125991.02	164392.63	32
29	60853.06	79353.04	76686.49	130401.06	126019.12	164330.27	31
30	60876.14	79335.33	76732.70	130322.54	126047.24	164267.96	30
31	60899.22	79317.62	76778.93	130244.07	126075.39	164205.72	29
32	60922.29	79299.90	76825.17	130165.67	126103.56	164143.54	28
33	60945.35	79282.18	76871.44	130087.32	126131.75	164081.42	27
34	60968.41	79264.45	76917.73	130009.04	126159.97	164019.36	26
35	60991.47	79246.71	76964.04	129930.81	126188.20	163957.26	25
36	61014.52	79228.96	77010.37	129852.65	126216.46	163895.42	24
37	61037.56	79211.21	77056.72	129774.54	126244.75	163833.55	23
38	61060.60	79193.45	77103.09	129696.49	126273.06	163771.73	22
39	61083.63	79175.69	77149.48	129618.50	126301.40	163709.97	21
40	61106.66	79157.92	77195.89	129540.57	126329.75	163648.28	20
41	61129.68	79140.14	77242.33	129462.69	126358.13	163586.64	19
42	61152.70	79122.35	77288.79	129384.88	126386.53	163525.07	18
43	61175.72	79104.56	77335.26	129307.12	126414.96	163463.55	17
44	61198.73	79086.76	77381.75	129229.43	126443.41	163402.10	16
45	61221.73	79068.96	77428.27	129151.79	126471.88	163340.70	15
46	61244.73	79051.15	77474.81	129074.21	126500.38	163279.37	14
47	61267.72	79033.33	77521.37	128996.69	126528.90	163218.09	13
48	61290.71	79015.50	77567.95	128919.22	126557.45	163156.88	12
49	61313.69	78997.67	77614.55	128841.82	126586.01	163095.72	11
50	61336.66	78979.83	77661.17	128764.47	126614.60	163034.62	10
51	61359.63	78961.98	77707.82	128687.18	126643.22	162973.59	9
52	61382.60	78944.13	77754.48	128609.95	126671.86	162912.61	8
53	61405.56	78926.27	77801.17	128532.77	126700.52	162851.69	7
54	61428.52	78908.41	77847.88	128455.66	126729.21	162790.83	6
55	61451.47	78890.54	77894.60	128378.60	126757.92	162730.03	5
56	61474.42	78872.66	77941.35	128301.60	126786.65	162669.29	4
57	61497.36	78854.77	77988.12	128224.66	126815.41	162608.61	3
58	61520.29	78836.88	78034.92	128147.76	126844.19	162547.99	2
59	61543.22	78818.98	78081.73	128070.93	126872.99	162487.43	1
60	61566.15	78801.07	78128.56	127994.16	126901.82	162426.92	0

38	Sinus		Tangens		Secans		
0	61566.15	78801.07	78128.56	127994.16	126901.82	162426.92	60
1	61589.07	78783.16	78175.42	127917.45	126930.67	162366.48	59
2	61611.98	78765.24	78222.29	127840.79	126959.55	162306.09	58
3	61634.89	78747.32	78269.19	127764.19	126988.45	162245.76	57
4	61657.79	78729.39	78316.11	127687.64	127017.37	162185.49	56
5	61680.69	78711.45	78363.05	127611.16	127046.32	162125.28	55
6	61703.59	78693.50	78410.02	127534.73	127075.29	162065.13	54
7	61726.48	78675.55	78457.00	127458.36	127104.29	162005.04	53
8	61749.36	78657.59	78504.00	127382.04	127133.31	161945.00	52
9	61772.24	78639.62	78551.03	127305.78	127162.35	161885.02	51
10	61795.11	78621.65	78598.08	127229.57	127191.42	161825.10	50
11	61817.98	78603.67	78645.15	127153.42	127220.51	161765.24	49
12	61840.84	78585.69	78692.24	127077.33	127249.63	161705.44	48
13	61863.70	78567.70	78739.35	127001.30	127278.77	161645.69	47
14	61886.55	78549.70	78786.49	126925.32	127307.94	161586.00	46
15	61909.40	78531.69	78833.64	126849.39	127337.12	161526.37	45
16	61932.24	78513.68	78880.82	126773.53	127366.34	161466.80	44
17	61955.07	78495.66	78928.02	126697.72	127395.57	161407.28	43
18	61977.90	78477.64	78975.24	126621.96	127424.84	161347.83	42
19	62000.73	78459.61	79022.48	126546.26	127454.12	161288.43	41
20	62023.55	78441.57	79069.75	126470.62	127483.43	161229.08	40
21	62046.36	78423.52	79117.03	126395.03	127512.76	161169.80	39
22	62069.17	78405.47	79164.34	126319.50	127542.12	161110.57	38
23	62091.98	78387.41	79211.67	126244.02	127571.50	161051.40	37
24	62114.78	78369.35	79259.02	126168.60	127600.91	160992.28	36
25	62137.57	78351.28	79306.40	126093.23	127630.34	160933.23	35
26	62160.36	78333.20	79353.79	126017.92	127659.80	160874.23	34
27	62183.14	78315.11	79401.21	125942.67	127689.28	160815.28	33
28	62205.92	78297.02	79448.65	125867.47	127718.78	160756.40	32
29	62228.69	78278.92	79496.11	125792.32	127748.31	160697.57	31
30	62251.46	78260.82	79543.59	125717.23	127777.87	160638.79	30
31	62274.22	78242.71	79591.10	125642.19	127807.45	160580.08	29
32	62296.98	78224.59	79638.62	125567.21	127837.05	160521.42	28
33	62319.73	78206.46	79686.17	125492.29	127866.67	160462.81	27
34	62342.48	78188.33	79733.74	125417.42	127896.32	160404.26	26
35	62365.22	78170.19	79781.34	125342.60	127926.00	160345.77	25
36	62387.96	78152.05	79828.95	125267.84	127955.70	160287.34	24
37	62410.69	78133.90	79876.59	125193.13	127985.43	160228.96	23
38	62433.42	78115.74	79924.25	125118.48	128015.18	160170.64	22
39	62456.14	78097.57	79971.93	125043.88	128044.95	160112.37	21
40	62478.85	78079.40	80019.63	124969.33	128074.75	160054.16	20
41	62501.56	78061.22	80067.36	124894.84	128104.57	159996.00	19
42	62524.26	78043.04	80115.11	124820.40	128134.42	159937.90	18
43	62546.96	78024.85	80162.88	124746.02	128164.30	159879.86	17
44	62569.66	78006.65	80210.67	124671.69	128194.20	159821.87	16
45	62592.35	77988.45	80258.48	124597.42	128224.12	159763.94	15
46	62615.03	77970.24	80306.32	124523.20	128254.07	159706.06	14
47	62637.71	77952.02	80354.18	124449.03	128284.04	159648.24	13
48	62660.38	77933.80	80402.06	124374.92	128314.04	159590.47	12
49	62683.05	77915.57	80449.97	124300.86	128344.06	159532.76	11
50	62705.71	77897.33	80497.90	124226.85	128374.11	159475.11	10
51	62728.37	77879.08	80545.85	124152.90	128404.18	159417.51	9
52	62751.02	77860.83	80593.82	124079.00	128434.28	159359.96	8
53	62773.66	77842.57	80641.81	124005.15	128464.40	159302.47	7
54	62796.30	77824.31	80689.83	123931.36	128494.55	159245.04	6
55	62818.94	77806.04	80737.87	123857.62	128524.72	159187.66	5
56	62841.57	77787.77	80785.93	123783.93	128554.92	159130.33	4
57	62864.20	77769.49	80834.01	123710.30	128585.14	159073.06	3
58	62886.82	77751.20	80882.12	123636.72	128615.39	159015.84	2
59	62909.43	77732.90	80930.25	123563.19	128645.66	158958.68	1
60	62932.04	77714.60	80978.40	123489.72	128675.96	158901.57	0
							51

39	Sinus		Tangens		Secans		
0	62932.04	77714.60	80978.40	123489.72	128675.96	158901.57	60
1	62954.64	77696.29	81026.58	123416.29	128706.28	158844.52	59
2	62977.24	77677.97	81074.78	123342.92	128736.63	158787.52	58
3	62999.83	77659.65	81123.00	123269.61	128767.00	158730.58	57
4	63022.42	77641.32	81171.24	123196.34	128797.40	158673.69	56
5	63045.00	77622.98	81219.51	123123.13	128827.82	158616.85	55
6	63067.58	77604.64	81267.80	123049.97	128858.27	158560.07	54
7	63090.15	77586.29	81316.11	122976.87	128888.75	158503.34	53
8	63112.72	77567.94	81364.44	122903.81	128919.25	158446.67	52
9	63135.28	77549.58	81412.80	122830.81	128949.77	158390.05	51
10	63157.84	77531.21	81461.18	122757.86	128980.32	158333.48	50
11	63180.39	77512.83	81509.58	122684.96	129010.90	158276.97	49
12	63202.93	77494.45	81558.01	122612.11	129041.50	158220.51	48
13	63225.47	77476.06	81606.46	122539.32	129072.13	158164.11	47
14	63248.00	77457.67	81654.93	122466.58	129102.78	158107.76	46
15	63270.53	77439.27	81703.43	122393.89	129133.46	158051.46	45
16	63293.05	77420.86	81751.95	122321.25	129164.16	157995.21	44
17	63315.57	77402.44	81800.49	122248.66	129194.89	157939.02	43
18	63338.08	77384.02	81849.05	122176.13	129225.64	157882.89	42
19	63360.59	77365.59	81897.64	122103.64	129256.42	157826.80	41
20	63383.09	77347.16	81946.25	122031.21	129287.23	157770.77	40
21	63405.59	77328.72	81994.88	121958.83	129318.06	157714.79	39
22	63428.08	77310.27	82043.54	121886.50	129348.92	157658.87	38
23	63450.57	77291.82	82092.22	121814.22	129379.80	157603.00	37
24	63473.05	77273.36	82140.93	121741.99	129410.71	157547.18	36
25	63495.53	77254.89	82189.65	121669.82	129441.64	157491.41	35
26	63518.00	77236.42	82238.40	121597.69	129472.60	157435.70	34
27	63540.46	77217.94	82287.18	121525.62	129503.59	157380.04	33
28	63562.92	77199.45	82335.97	121453.59	129534.60	157324.43	32
29	63585.37	77180.96	82384.79	121381.62	129565.64	157268.87	31
30	63607.82	77162.46	82433.64	121309.70	129596.70	157213.37	30
31	63630.26	77143.95	82482.51	121237.83	129627.79	157157.92	29
32	63652.70	77125.44	82531.40	121166.01	129658.90	157102.52	28
33	63675.13	77106.92	82580.31	121094.24	129690.04	157047.17	27
34	63697.56	77088.39	82629.25	121022.52	129721.21	156991.88	26
35	63719.98	77069.86	82678.21	120950.85	129752.40	156936.94	25
36	63742.40	77051.32	82727.19	120879.23	129783.62	156881.45	24
37	63764.81	77032.78	82776.20	120807.67	129814.87	156826.31	23
38	63787.21	77014.23	82825.23	120736.15	129846.14	156771.23	22
39	63809.61	76995.67	82874.29	120664.68	129877.44	156716.19	21
40	63832.01	76977.10	82923.37	120593.27	129908.76	156661.21	20
41	63854.40	76958.53	82972.47	120521.90	129940.11	156606.28	19
42	63876.78	76939.95	83021.60	120450.58	129971.48	156551.41	18
43	63899.16	76921.37	83070.75	120379.31	130002.88	156496.58	17
44	63921.53	76902.78	83119.92	120308.10	130034.31	156441.81	16
45	63943.90	76884.18	83169.12	120236.93	130065.76	156387.08	15
46	63966.26	76865.58	83218.34	120165.81	130097.24	156332.41	14
47	63988.62	76846.97	83267.59	120094.75	130128.75	156277.79	13
48	64010.97	76828.35	83316.86	120023.73	130160.28	156223.22	12
49	64033.32	76809.73	83366.15	119952.76	130191.84	156168.70	11
50	64055.66	76791.10	83415.47	119881.84	130223.43	156114.24	10
51	64077.99	76772.46	83464.81	119810.97	130255.04	156059.82	9
52	64100.32	76753.82	83514.18	119740.15	130286.68	156005.46	8
53	64122.64	76735.17	83563.57	119669.38	130318.34	155951.15	7
54	64144.96	76716.51	83612.98	119598.66	130350.03	155896.89	6
55	64167.27	76697.85	83662.42	119527.99	130381.75	155842.67	5
56	64189.58	76679.18	83711.88	119457.36	130413.49	155788.51	4
57	64211.88	76660.51	83761.36	119386.79	130445.26	155734.41	3
58	64234.18	76641.83	83810.87	119316.26	130477.06	155680.35	2
59	64256.47	76623.14	83860.40	119245.79	130508.88	155626.34	1
60	64278.76	76604.44	83909.96	119175.36	130540.73	155572.38	0
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40	Sinus		Tangens		Secans		
0	64278.76	76604.44	83909.96	119175.36	130542.73	155572.38	60
1	64301.04	76585.74	83959.54	119104.98	130572.61	155518.48	59
2	64323.32	76567.03	84009.15	119034.65	130604.51	155464.62	58
3	64345.59	76548.32	84058.78	118964.37	130636.44	155410.81	57
4	64367.85	76529.60	84108.44	118894.14	130668.39	155357.05	56
5	64390.11	76510.87	84158.12	118823.95	130700.37	155303.35	55
6	64412.36	76492.14	84207.82	118753.82	130732.38	155249.70	54
7	64434.61	76473.40	84257.55	118683.73	130764.42	155196.09	53
8	64456.85	76454.65	84307.30	118613.69	130796.49	155142.54	52
9	64479.09	76435.90	84357.08	118543.70	130828.58	155089.04	51
10	64501.32	76417.14	84406.88	118473.76	130860.70	155035.58	50
11	64523.55	76398.37	84456.70	118403.87	130892.84	154982.18	49
12	64545.77	76379.60	84506.55	118334.02	130925.01	154928.82	48
13	64567.98	76360.82	84556.43	118264.22	130957.21	154875.52	47
14	64590.19	76342.04	84606.33	118194.47	130989.43	154822.26	46
15	64612.40	76323.25	84656.25	118124.77	131021.68	154769.06	45
16	64634.60	76304.45	84706.20	118055.12	131053.96	154715.90	44
17	64656.79	76285.64	84756.17	117985.51	131086.26	154662.80	43
18	64678.98	76266.83	84806.17	117915.95	131118.59	154609.74	42
19	64701.16	76248.01	84856.19	117846.44	131150.95	154556.73	41
20	64723.34	76229.19	84906.24	117776.98	131183.34	154503.78	40
21	64745.51	76210.36	84956.31	117707.56	131215.75	154450.87	39
22	64767.67	76191.52	85006.40	117638.20	131248.19	154398.01	38
23	64789.83	76172.68	85056.52	117568.88	131280.66	154345.20	37
24	64811.99	76153.83	85106.67	117499.60	131313.16	154292.44	36
25	64834.14	76134.97	85156.84	117430.38	131345.68	154239.73	35
26	64856.28	76116.11	85207.04	117361.20	131378.23	154187.06	34
27	64878.42	76097.24	85257.26	117292.07	131410.81	154134.45	33
28	64900.55	76078.37	85307.50	117222.98	131443.41	154081.89	32
29	64922.68	76059.49	85357.77	117153.95	131476.04	154029.37	31
30	64944.80	76040.60	85408.07	117084.96	131508.70	153976.90	30
31	64966.92	76021.70	85458.39	117016.01	131541.39	153924.49	29
32	64989.03	76002.80	85508.73	116947.12	131574.10	153872.12	28
33	65011.14	75983.89	85559.10	116878.27	131606.84	153819.80	27
34	65033.24	75964.98	85609.50	116809.47	131639.61	153767.52	26
35	65055.33	75946.06	85659.92	116740.71	131672.41	153715.30	25
36	65077.42	75927.13	85710.37	116672.00	131705.23	153663.12	24
37	65099.50	75908.20	85760.84	116603.34	131738.08	153611.00	23
38	65121.58	75889.26	85811.33	116534.72	131770.96	153558.92	22
39	65143.66	75870.31	85861.85	116466.15	131803.86	153506.89	21
40	65165.72	75851.36	85912.40	116397.63	131836.79	153454.91	20
41	65187.78	75832.40	85962.97	116329.16	131869.75	153402.97	19
42	65209.84	75813.43	86013.57	116260.73	131902.74	153351.09	18
43	65231.89	75794.46	86064.19	116192.34	131935.76	153299.25	17
44	65253.94	75775.48	86114.84	116124.00	131968.81	153247.46	16
45	65275.98	75756.50	86165.51	116055.71	132001.88	153195.72	15
46	65298.01	75737.51	86216.21	115987.47	132034.98	153144.03	14
47	65320.04	75718.51	86266.93	115919.27	132068.11	153092.38	13
48	65342.06	75699.50	86317.68	115851.11	132101.26	153040.78	12
49	65364.08	75680.49	86368.46	115783.01	132134.44	152989.23	11
50	65386.09	75661.47	86419.26	115714.95	132167.65	152937.73	10
51	65408.10	75642.45	86470.09	115646.93	132200.89	152886.27	9
52	65430.10	75623.42	86520.94	115578.96	132234.16	152834.87	8
53	65452.09	75604.39	86571.81	115511.04	132267.45	152783.51	7
54	65474.08	75585.35	86622.71	115443.16	132300.77	152732.19	6
55	65496.06	75566.30	86673.64	115375.32	132334.12	152680.93	5
56	65518.04	75547.24	86724.60	115307.54	132367.50	152629.71	4
57	65540.01	75528.18	86775.58	115239.79	132400.91	152578.54	3
58	65561.98	75509.11	86826.59	115172.10	132434.35	152527.41	2
59	65583.94	75490.04	86877.62	115104.45	132467.81	152476.34	1
60	65605.90	75470.96	86928.68	115036.84	132501.30	152425.31	0

41	Sinus		Tangens		Secans		
0	65605.90	75470.96	86928.68	115036.84	132501.30	152425.31	60
1	65627.85	75451.87	86979.76	114969.28	132534.82	152374.33	59
2	65649.80	75432.78	87030.87	114901.76	132568.37	152323.39	58
3	65671.74	75413.68	87082.00	114834.29	132601.94	152272.50	57
4	65693.67	75394.57	87133.16	114766.87	132635.54	152221.66	56
5	65715.60	75375.46	87184.35	114699.49	132669.18	152170.87	55
6	65737.52	75356.34	87235.56	114632.15	132701.84	152120.11	54
7	65759.44	75337.21	87286.80	114564.86	132736.53	152069.42	53
8	65781.35	75318.08	87338.06	114497.62	132770.25	152018.76	52
9	65803.26	75298.94	87389.35	114430.41	132803.99	151968.15	51
10	65825.16	75279.80	87440.67	114363.26	132837.76	151917.59	50
11	65847.06	75260.65	87492.01	114296.15	132871.56	151867.08	49
12	65868.95	75241.49	87543.38	114229.08	132905.39	151816.61	48
13	65890.83	75222.33	87594.78	114162.06	132939.25	151766.19	47
14	65912.71	75203.16	87646.20	114095.08	132973.14	151715.81	46
15	65934.58	75183.98	87697.65	114028.15	133007.06	151665.48	45
16	65956.45	75164.80	87749.12	113961.26	133041.00	151615.20	44
17	65978.31	75145.61	87800.62	113894.41	133074.97	151564.96	43
18	66000.17	75126.41	87852.15	113827.61	133108.97	151514.77	42
19	66022.02	75107.21	87903.70	113760.85	133143.00	151464.62	41
20	66043.86	75088.00	87955.28	113694.14	133177.06	151414.52	40
21	66065.70	75068.79	88006.89	113627.47	133211.15	151364.47	39
22	66087.53	75049.57	88058.52	113560.85	133245.27	151314.46	38
23	66109.36	75030.34	88110.18	113494.27	133279.42	151264.50	37
24	66131.18	75011.11	88161.86	113427.73	133313.59	151214.59	36
25	66153.00	74991.87	88213.57	113361.24	133347.79	151164.72	35
26	66174.81	74972.62	88265.31	113294.79	133382.02	151114.89	34
27	66196.62	74953.37	88317.09	113228.39	133416.28	151065.11	33
28	66218.42	74934.11	88368.86	113162.03	133450.57	151015.38	32
29	66240.22	74914.84	88420.68	113095.71	133484.89	150965.69	31
30	66262.01	74895.57	88472.53	113029.44	133519.24	150916.05	30
31	66283.79	74876.29	88524.40	112963.21	133553.62	150866.45	29
32	66305.57	74857.01	88576.30	112897.02	133588.03	150816.90	28
33	66327.34	74837.72	88628.22	112830.88	133622.46	150767.39	27
34	66349.11	74818.42	88680.17	112764.78	133656.92	150717.93	26
35	66370.87	74799.12	88732.15	112698.72	133691.41	150668.52	25
36	66392.62	74779.81	88784.16	112632.71	133725.94	150619.15	24
37	66414.37	74760.49	88836.20	112566.74	133760.49	150569.82	23
38	66436.11	74741.17	88888.26	112500.81	133795.07	150520.54	22
39	66457.85	74721.84	88940.34	112434.93	133829.68	150471.31	21
40	66479.59	74702.51	88992.45	112369.09	133864.32	150422.11	20
41	66501.32	74683.17	89044.59	112303.29	133898.99	150372.97	19
42	66523.04	74663.82	89096.75	112237.54	133933.69	150323.87	18
43	66544.75	74644.46	89148.94	112171.83	133968.42	150274.81	17
44	66566.46	74625.10	89201.16	112106.16	134003.17	150225.80	16
45	66588.17	74605.74	89253.41	112040.53	134037.95	150176.83	15
46	66609.87	74586.37	89305.69	111974.95	134072.76	150127.91	14
47	66631.56	74566.99	89357.99	111909.41	134107.61	150079.03	13
48	66653.25	74547.60	89410.32	111843.91	134142.48	150030.20	12
49	66674.93	74528.21	89462.68	111778.46	134177.38	149981.41	11
50	66696.61	74508.81	89515.06	111713.05	134212.32	149932.67	10
51	66718.28	74489.40	89567.47	111647.68	134247.28	149883.97	9
52	66739.94	74469.99	89619.91	111582.35	134282.27	149835.31	8
53	66761.60	74450.57	89672.38	111517.06	134317.29	149786.70	7
54	66783.26	74431.15	89724.87	111451.82	134352.34	149738.13	6
55	66804.91	74411.72	89777.39	111386.62	134387.42	149689.61	5
56	66826.55	74392.29	89829.94	111321.46	134422.53	149641.13	4
57	66848.18	74372.85	89882.52	111256.35	134457.67	149592.70	3
58	66869.81	74353.40	89935.12	111191.27	134492.84	149544.30	2
59	66891.44	74333.94	89987.75	111126.24	134528.04	149495.96	1
60	66913.06	74314.48	90040.41	111061.25	134563.27	149447.65	0
							48

42	Sinus		Tangens		Secans		
0	66913.06	74314.48	90040.41	111061.25	134563.27	149447.65	60
1	66934.67	74295.01	90093.09	110996.30	134598.53	149399.40	59
2	66956.28	74275.54	90145.80	110931.40	134633.82	149351.18	58
3	66977.88	74256.06	90198.54	110866.53	134669.14	149303.01	57
4	66999.48	74236.57	90251.31	110801.71	134704.49	149254.88	56
5	67021.07	74217.08	90304.11	110736.93	134739.87	149206.80	55
6	67042.66	74197.58	90356.94	110672.19	134775.28	149158.75	54
7	67064.24	74178.08	90409.79	110607.50	134810.72	149110.76	53
8	67085.82	74158.57	90462.67	110542.84	134846.19	149062.80	52
9	67107.39	74139.05	90515.58	110478.23	134881.69	149014.89	51
10	67128.95	74119.53	90568.51	110413.65	134917.21	148967.03	50
11	67150.51	74100.00	90621.47	110349.12	134952.77	148919.20	49
12	67172.06	74080.46	90674.46	110284.63	134988.36	148817.42	48
13	67193.61	74060.92	90727.48	110220.19	135023.98	148823.69	47
14	67215.15	74041.37	90780.53	110155.78	135059.63	148775.99	46
15	67236.68	74021.81	90833.60	110091.41	135095.31	148728.34	45
16	67258.21	74002.25	90886.71	110027.09	135131.02	148680.73	44
17	67279.73	73982.68	90939.84	109962.81	135166.76	148633.17	43
18	67301.25	73963.11	90993.00	109898.56	135202.54	148585.65	42
19	67322.76	73943.53	91046.19	109834.36	135238.34	148538.17	41
20	67344.27	73923.94	91099.41	109770.20	135274.17	148490.73	40
21	67365.77	73904.35	91152.65	109706.08	135310.03	148443.34	39
22	67387.27	73884.75	91205.92	109642.01	135345.93	148395.99	38
23	67408.76	73865.15	91259.22	109577.97	135381.86	148348.68	37
24	67430.24	73845.54	91312.55	109513.97	135417.81	148301.42	36
25	67451.72	73825.92	91365.91	109450.02	135453.79	148254.20	35
26	67473.19	73806.29	91419.29	109386.10	135489.80	148207.02	34
27	67494.66	73786.66	91472.70	109322.23	135525.85	148159.88	33
28	67516.12	73767.02	91526.15	109258.40	135561.93	148112.78	32
29	67537.57	73747.38	91579.62	109194.60	135598.03	148065.73	31
30	67559.02	73727.73	91633.12	109130.85	135634.17	148018.72	30
31	67580.46	73708.08	91686.65	109067.14	135670.34	147971.76	29
32	67601.90	73688.42	91740.20	109003.47	135706.54	147924.83	28
33	67623.33	73668.75	91793.79	108939.83	135742.77	147877.95	27
34	67644.76	73649.07	91847.40	108876.24	135779.03	147831.11	26
35	67666.18	73629.39	91901.04	108812.69	135815.32	147784.31	25
36	67687.60	73609.71	91954.71	108749.18	135851.64	147737.55	24
37	67709.01	73590.02	92008.41	108685.71	135888.00	147690.84	23
38	67730.41	73570.32	92062.14	108622.28	135924.38	147644.17	22
39	67751.81	73550.61	92115.90	108558.89	135960.80	147597.54	21
40	67773.20	73530.90	92169.68	108495.54	135997.25	147550.95	20
41	67794.59	73511.18	92223.50	108432.23	136033.72	147504.40	19
42	67815.97	73491.46	92277.34	108368.96	136070.23	147457.90	18
43	67837.34	73471.73	92331.22	108305.73	136106.77	147411.44	17
44	67858.71	73451.99	92385.12	108242.54	136143.34	147365.01	16
45	67880.07	73432.25	92439.05	108179.39	136179.95	147318.64	15
46	67901.43	73412.50	92493.01	108116.28	136216.58	147272.30	14
47	67922.78	73392.75	92547.00	108053.21	136253.24	147226.00	13
48	67944.13	73372.99	92601.01	107990.18	136289.94	147179.75	12
49	67965.47	73353.22	92655.06	107927.18	136326.67	147133.53	11
50	67986.81	73333.45	92709.14	107864.23	136363.43	147087.36	10
51	68008.14	73313.67	92763.24	107801.32	136400.22	147041.23	9
52	68029.46	73293.88	92817.38	107738.44	136437.04	146995.14	8
53	68050.78	73274.09	92871.54	107675.61	136473.89	146949.10	7
54	68072.09	73254.29	92925.73	107612.82	136510.78	146903.09	6
55	68093.39	73234.48	92979.96	107550.06	136546.70	146857.13	5
56	68114.69	73214.67	93034.21	107487.34	136584.64	146811.20	4
57	68135.99	73194.85	93088.49	107424.67	136621.62	146765.32	3
58	68157.28	73175.03	93142.80	107362.03	136658.63	146719.48	2
59	68178.56	73155.20	93197.14	107299.43	136695.67	146673.68	1
60	68199.84	73135.37	93251.51	107236.87	136732.75	146627.92	0

43	Sinus.		Tangens.		Secans.		
0	68199.84	73135.37	93251.51	107236.87	136732.75	146627.92	60
1	68221.11	73115.52	93305.91	107174.35	136769.85	146582.20	59
2	68242.37	73095.68	93360.34	107111.87	136806.99	146536.52	58
3	68263.63	73075.83	93414.79	107049.43	136844.16	146490.88	57
4	68284.88	73055.97	93469.28	106987.02	136881.36	146445.29	56
5	68306.13	73036.10	93523.80	106924.66	136918.59	146399.73	55
6	68327.37	73016.23	93578.34	106862.33	136955.86	146354.22	54
7	68348.61	72996.35	93632.92	106800.04	136993.15	146308.75	53
8	68369.84	72976.46	93687.53	106737.79	137030.48	146263.31	52
9	68391.07	72956.57	93742.16	106675.58	137067.84	146217.92	51
10	68412.29	72936.67	93796.83	106613.41	137105.23	146172.57	50
11	68433.50	72916.77	93851.52	106551.28	137142.66	146127.26	49
12	68454.71	72896.86	93906.25	106489.18	137180.11	146081.98	48
13	68475.91	72876.94	93961.01	106427.13	137217.60	146036.75	47
14	68497.11	72857.02	94015.79	106365.11	137255.12	145991.56	46
15	68518.30	72837.09	94070.61	106303.13	137292.68	145946.41	45
16	68539.48	72817.16	94125.45	106241.19	137330.26	145901.30	44
17	68560.66	72797.22	94180.33	106179.29	137367.88	145856.23	43
18	68581.83	72777.27	94235.23	106117.42	137405.53	145811.20	42
19	68603.00	72757.32	94290.17	106055.60	137443.21	145766.21	41
20	68624.16	72737.36	94345.13	105993.81	137480.92	145721.27	40
21	68645.32	72717.40	94400.13	105932.06	137518.67	145676.36	39
22	68666.47	72697.43	94455.16	105870.34	137556.45	145631.49	38
23	68687.61	72677.45	94510.21	105808.67	137594.26	145586.66	37
24	68708.75	72657.47	94565.30	105747.03	137632.10	145541.87	36
25	68729.88	72637.48	94620.42	105685.44	137669.98	145497.12	35
26	68751.01	72617.48	94675.56	105623.88	137707.89	145452.41	34
27	68772.13	72597.48	94730.74	105562.35	137745.83	145407.74	33
28	68793.24	72577.47	94785.95	105500.87	137783.80	145363.11	32
29	68814.35	72557.46	94841.19	105439.42	137821.81	145318.52	31
30	68835.45	72537.44	94896.46	105378.01	137859.85	145273.97	30
31	68856.55	72517.41	94951.76	105316.64	137897.92	145229.46	29
32	68877.64	72497.38	95007.09	105255.31	137936.02	145184.98	28
33	68898.73	72477.34	95062.45	105194.01	137974.16	145140.55	27
34	68919.81	72457.29	95117.84	105132.75	138012.33	145096.16	26
35	68940.89	72437.24	95173.26	105071.53	138050.53	145051.81	25
36	68961.96	72417.18	95228.71	105010.34	138088.77	145007.49	24
37	68983.02	72397.12	95284.20	104949.20	138127.04	144963.22	23
38	69004.07	72377.05	95339.71	104888.09	138165.34	144918.98	22
39	69025.12	72356.98	95395.26	104827.02	138203.67	144874.78	21
40	69046.17	72336.90	95450.83	104765.98	138242.04	144830.63	20
41	69067.21	72316.81	95506.44	104704.98	138280.44	144786.51	19
42	69088.24	72296.71	95562.08	104644.02	138318.87	144742.43	18
43	69109.27	72276.61	95617.74	104583.10	138357.34	144698.39	17
44	69130.29	72256.51	95673.44	104522.21	138395.84	144654.39	16
45	69151.31	72236.40	95729.17	104461.36	138434.37	144610.43	15
46	69172.32	72216.28	95784.94	104400.55	138472.94	144566.51	14
47	69193.32	72196.15	95840.73	104339.77	138511.54	144522.62	13
48	69214.32	72176.02	95896.55	104279.04	138550.27	144478.78	12
49	69235.31	72155.88	95952.41	104218.33	138588.83	144434.79	11
50	69256.30	72153.74	96008.29	104157.67	138627.53	144391.20	10
51	69277.28	72115.59	96064.21	104097.04	138666.26	144347.48	9
52	69298.25	72095.44	96120.16	104036.45	138705.03	144303.79	8
53	69319.22	72075.28	96176.14	103975.89	138743.83	144260.13	7
54	69340.18	72055.11	96232.15	103915.37	138782.66	144216.52	6
55	69361.14	72034.94	96288.19	103854.89	138821.53	144172.95	5
56	69382.09	72014.76	96344.27	103794.45	138860.42	144129.41	4
57	69403.04	71994.57	96400.37	103734.04	138899.36	144085.91	3
58	69423.98	71974.38	96456.51	103673.67	128938.32	144042.46	2
59	69444.91	71954.18	96512.68	103613.33	138977.32	143999.04	1
60	69465.84	71933.98	96568.88	103553.03	139016.36	143955.65	0

Canon Sinuum, Tangentium & Secantium.

42	Sinus		Tangens		Secans		
0	66913.06	74314.48	90040.41	111061.25	134563.27	149447.65	60
1	66934.67	74295.01	90093.09	110996.30	134598.53	149399.40	59
2	66956.28	74275.54	90145.80	110931.40	134633.82	149351.18	58
3	66977.88	74256.06	90198.54	110866.53	134669.14	149303.01	57
4	66999.48	74236.57	90251.31	110801.71	134704.49	149254.88	56
5	67021.07	74217.08	90304.11	110736.93	134739.87	149206.80	55
6	67042.66	74197.58	90356.94	110672.19	134775.28	149158.75	54
7	67064.24	74178.08	90409.79	110607.50	134810.72	149110.76	53
8	67085.82	74158.57	90462.67	110542.84	134846.19	149062.80	52
9	67107.39	74139.05	90515.58	110478.23	134881.69	149014.89	51
10	67128.95	74119.53	90568.51	110413.65	134917.21	148967.03	50
11	67150.51	74100.00	90621.47	110349.12	134952.77	148919.20	49
12	67172.06	74080.46	90674.46	110284.63	134988.36	148817.42	48
13	67193.61	74060.92	90727.48	110220.19	135023.98	148823.69	47
14	67215.15	74041.37	90780.53	110155.78	135059.63	148775.99	46
15	67236.68	74021.81	90833.60	110091.41	135095.31	148728.34	45
16	67258.21	74002.25	90886.71	110027.09	135131.02	148680.73	44
17	67279.73	73982.68	90939.84	109962.81	135166.76	148633.17	43
18	67301.25	73963.11	90993.00	109898.56	135202.54	148585.65	42
19	67322.76	73943.53	91046.19	109834.36	135238.34	148538.17	41
20	67344.27	73923.94	91099.41	109770.20	135274.17	148490.73	40
21	67365.77	73904.35	91152.65	109706.08	135310.03	148443.34	39
22	67387.27	73884.75	91205.92	109642.01	135345.93	148395.99	38
23	67408.76	73865.15	91259.22	109577.97	135381.86	148348.68	37
24	67430.24	73845.54	91312.55	109513.97	135417.81	148301.42	36
25	67451.72	73825.92	91365.91	109450.01	135453.79	148254.20	35
26	67473.19	73806.29	91419.29	109386.10	135489.80	148207.02	34
27	67494.66	73786.66	91472.70	109322.23	135525.85	148159.88	33
28	67516.12	73767.02	91526.15	109258.40	135561.93	148112.78	32
29	67537.57	73747.38	91579.62	109194.60	135598.03	148065.73	31
30	67559.02	73727.73	91633.12	109130.85	135634.17	148018.72	30
31	67580.46	73708.08	91686.65	109067.14	135670.34	147971.76	29
32	67601.90	73688.42	91740.20	109003.47	135706.54	147924.83	28
33	67623.33	73668.75	91793.79	108939.83	135742.77	147877.95	27
34	67644.76	73649.07	91847.40	108876.24	135779.03	147831.11	26
35	67666.18	73629.39	91901.04	108812.69	135815.32	147784.31	25
36	67687.60	73609.71	91954.71	108749.18	135851.64	147737.55	24
37	67709.01	73590.02	92008.41	108685.71	135888.00	147690.84	23
38	67730.41	73570.32	92062.14	108622.28	135924.38	147644.17	22
39	67751.81	73550.61	92115.90	108558.89	135960.80	147597.54	21
40	67773.20	73530.90	92169.68	108495.54	135997.25	147550.95	20
41	67794.59	73511.18	92223.50	108432.23	136033.72	147504.40	19
42	67815.97	73491.46	92277.34	108368.96	136070.23	147457.90	18
43	67837.34	73471.73	92331.22	108305.73	136106.77	147411.44	17
44	67858.71	73451.99	92385.12	108242.54	136143.34	147365.01	16
45	67880.07	73432.25	92439.05	108179.39	136179.95	147318.64	15
46	67901.43	73412.50	92493.01	108116.28	136216.58	147272.30	14
47	67922.78	73392.75	92547.00	108053.21	136253.24	147226.00	13
48	67944.13	73372.99	92601.01	107990.18	136289.94	147179.75	12
49	67965.47	73353.22	92655.06	107927.18	136326.67	147133.53	11
50	67986.81	73333.45	92709.14	107864.23	136363.43	147087.36	10
51	68008.14	73313.67	92763.24	107801.32	136400.22	147041.23	9
52	68029.46	73293.88	92817.38	107738.44	136437.04	146995.14	8
53	68050.78	73274.09	92871.54	107675.61	136473.89	146949.10	7
54	68072.09	73254.29	92925.73	107612.82	136510.78	146903.09	6
55	68093.39	73234.48	92979.96	107550.06	136546.70	146857.13	5
56	68114.69	73214.67	93034.21	107487.34	136584.64	146811.20	4
57	68135.99	73194.85	93088.49	107424.67	136621.62	146765.32	3
58	68157.28	73175.03	93142.80	107362.03	136658.63	146719.48	2
59	68178.56	73155.20	93197.14	107299.43	136695.67	146673.68	1
60	68199.84	73135.37	93251.51	107236.87	136732.75	146627.92	0

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43	Sinus.		Tangens.		Secans.		
0	68199.84	73135.37	93251.51	107236.87	136732.75	146627.92	60
1	68221.11	73115.52	93305.91	107174.35	136769.85	146582.20	59
2	68242.37	73095.68	93360.34	107111.87	136806.99	146536.52	58
3	68263.63	73075.83	93414.79	107049.43	136844.16	146490.88	57
4	68284.88	73055.97	93469.28	106987.02	136881.36	146445.29	56
5	68306.13	73036.10	93523.80	106924.66	136918.59	146399.73	55
6	68327.37	73016.23	93578.34	106862.33	136955.86	146354.22	54
7	68348.61	72996.35	93632.92	106800.04	136993.15	146308.75	53
8	68369.84	72976.46	93687.53	106737.79	137030.48	146263.31	52
9	68391.07	72956.57	93742.16	106675.58	137067.84	146217.92	51
10	68412.29	72936.67	93796.83	106613.41	137105.23	146172.57	50
11	68433.50	72916.77	93851.52	106551.28	137142.66	146127.26	49
12	68454.71	72896.86	93906.25	106489.18	137180.11	146081.98	48
13	68475.91	72876.94	93961.01	106427.13	137217.60	146036.75	47
14	68497.11	72857.02	94015.79	106365.11	137255.12	145991.56	46
15	68518.30	72837.09	94070.61	106303.13	137292.68	145946.41	45
16	68539.48	72817.16	94125.45	106241.19	137330.26	145901.30	44
17	68560.66	72797.22	94180.33	106179.29	137367.88	145856.23	43
18	68581.83	72777.27	94235.23	106117.42	137405.53	145811.20	42
19	68603.00	72757.32	94290.17	106055.60	137443.21	145766.21	41
20	68624.16	72737.36	94345.13	105993.81	137480.92	145721.27	40
21	68645.32	72717.40	94400.13	105932.06	137518.67	145676.36	39
22	68666.47	72697.43	94455.16	105870.34	137556.45	145631.49	38
23	68687.61	72677.45	94510.21	105808.67	137594.26	145586.66	37
24	68708.75	72657.47	94565.30	105747.03	137632.10	145541.87	36
25	68729.88	72637.48	94620.42	105685.44	137669.98	145497.12	35
26	68751.01	72617.48	94675.56	105623.88	137707.89	145452.41	34
27	68772.13	72597.48	94730.74	105562.35	137745.83	145407.74	33
28	68793.24	72577.47	94785.95	105500.87	137783.80	145363.11	32
29	68814.35	72557.46	94841.19	105439.42	137821.81	145318.52	31
30	68835.45	72537.44	94896.46	105378.01	137859.85	145273.97	30
31	68856.55	72517.41	94951.76	105316.64	137897.92	145229.46	29
32	68877.64	72497.38	95007.09	105255.31	137936.02	145184.98	28
33	68898.73	72477.34	95062.45	105194.01	137974.16	145140.55	27
34	68919.81	72457.29	95117.84	105132.75	138012.33	145096.16	26
35	68940.89	72437.24	95173.26	105071.53	138050.53	145051.81	25
36	68961.96	72417.18	95228.71	105010.34	138088.77	145007.49	24
37	68983.02	72397.12	95284.20	104949.20	138127.04	144963.22	23
38	69004.07	72377.05	95339.71	104888.09	138165.34	144918.98	22
39	69025.12	72356.98	95395.26	104827.02	138203.67	144874.78	21
40	69046.17	72336.90	95450.83	104765.98	138242.04	144830.63	20
41	69067.21	72316.81	95506.44	104704.98	138280.44	144786.51	19
42	69088.24	72296.71	95562.08	104644.02	138318.87	144742.43	18
43	69109.27	72276.61	95617.74	104583.10	138357.34	144698.39	17
44	69130.29	72256.51	95673.44	104522.21	138395.84	144654.39	16
45	69151.31	72236.40	95729.17	104461.36	138434.37	144610.43	15
46	69172.32	72216.28	95784.94	104400.55	138472.94	144566.51	14
47	69193.32	72196.15	95840.73	104339.77	138511.54	144522.62	13
48	69214.32	72176.02	95896.55	104279.04	138550.17	144478.78	12
49	69235.31	72155.88	95952.41	104218.33	138588.83	144434.79	11
50	69256.30	72153.74	96008.29	104157.67	138627.53	144391.20	10
51	69277.28	72115.59	96064.21	104097.04	138666.26	144347.48	9
52	69298.25	72095.44	96120.16	104036.45	138705.03	144303.79	8
53	69319.22	72075.28	96176.14	103975.89	138743.83	144260.13	7
54	69340.18	72055.11	96232.15	103915.37	138782.66	144216.52	6
55	69361.14	72034.94	96288.19	103854.89	138821.53	144172.95	5
56	69382.09	72014.76	96344.27	103794.45	138860.42	144129.41	4
57	69403.04	71994.57	96400.37	103734.04	138899.36	144085.91	3
58	69423.98	71974.38	96456.51	103673.67	128938.32	144042.46	2
59	69444.91	71954.18	96512.68	103613.33	138977.32	143999.04	1
60	69465.84	71933.98	96568.88	103553.03	139016.36	143955.65	0
							46

44	Sinus		Tangens		Secans		
0	69465.84	71933.98	96568.88	103553.03	139016.36	143955.65	60
1	69486.76	71913.77	96625.11	103492.77	139055.43	143912.31	59
2	69507.67	71893.55	96681.37	103432.54	130094.53	143869.00	58
3	69528.58	71873.33	96737.67	103372.35	139133.66	143825.74	57
4	69549.49	71853.10	96794.00	103312.20	139172.83	143782.51	56
5	69570.39	71832.87	96850.35	103252.08	139212.03	143739.32	55
6	69591.28	71812.63	96906.74	103191.99	139251.27	143696.16	54
7	69612.17	71792.38	96963.16	103131.95	139290.54	143653.05	53
8	69633.05	71772.13	97019.62	103071.94	139329.85	143609.97	52
9	69653.92	71751.87	97076.10	103011.96	139369.18	143566.93	51
10	69674.79	71731.61	97132.62	102952.03	119408.56	143523.93	50
11	69695.65	71711.34	97189.17	102892.12	139447.96	143480.97	49
12	69716.51	71691.06	97245.75	102832.26	139487.40	143438.05	48
13	69737.36	71670.78	97302.36	102772.43	139526.88	143395.16	47
14	69758.21	71650.49	97359.01	102712.63	139566.39	143352.31	46
15	69779.05	71630.19	97415.69	102652.87	139605.93	143309.50	45
16	69799.88	71609.89	97472.40	102593.15	139645.51	143266.72	44
17	69820.71	71589.58	97529.14	102533.46	139685.12	143223.99	43
18	69841.53	71569.27	97585.91	102473.81	139724.77	143181.29	42
19	69862.34	71548.95	97642.72	102414.19	139764.45	143138.63	41
20	69883.15	71528.63	97699.56	102354.61	139804.16	143096.00	40
21	69903.96	71508.30	97756.43	102295.06	139843.91	143053.42	39
22	69924.76	71487.96	97813.33	102235.55	139883.69	143010.87	38
23	69945.55	71467.62	97870.27	102176.08	139923.51	142968.36	37
24	69966.33	71447.27	97927.24	102116.64	139963.36	142925.88	36
25	69987.11	71426.91	97984.24	102057.23	140003.25	142883.44	35
26	70007.89	71406.55	98041.27	101997.86	140043.17	142841.04	34
27	70028.66	71386.18	98098.33	101938.53	140083.13	142798.68	33
28	70049.42	71365.81	98155.43	101879.23	140123.12	142756.36	32
29	70070.18	71345.43	98212.56	101819.97	140163.15	142714.07	31
30	70090.93	71325.05	98269.73	101760.74	140203.21	142671.82	30
31	70111.67	71304.66	98326.92	101701.55	140243.30	142629.61	29
32	70132.41	71284.26	98384.15	101642.39	140283.43	142587.43	28
33	70153.14	71263.85	98441.41	101583.26	140323.60	142545.29	27
34	70173.87	71243.44	98498.71	101524.17	140363.80	142503.19	26
35	70194.59	71223.02	98556.03	101465.12	140404.03	142461.12	25
36	70215.30	71202.60	98613.39	101406.10	140444.30	142419.09	24
37	70236.01	71182.17	98670.79	101347.12	140484.60	142377.10	23
38	70256.71	71161.74	98728.21	101288.17	140524.94	142335.14	22
39	70277.41	71141.30	98785.67	101229.25	140565.32	142293.23	21
40	70298.10	71120.86	98843.16	101170.37	140605.73	142251.34	20
41	70318.79	71100.41	98900.69	101111.53	140646.17	142209.50	19
42	70339.47	71079.95	98958.25	101052.72	140686.65	142167.69	18
43	70360.14	71059.48	99015.84	100993.94	140727.17	142125.92	17
44	70380.81	71039.01	99073.46	100935.20	140767.72	142084.18	16
45	70401.47	71018.54	99131.12	100876.49	140808.31	142042.48	15
46	70422.13	70998.06	99188.81	100817.82	140848.93	142000.82	14
47	70442.78	70977.57	99246.54	100759.18	140889.58	141959.19	13
48	70463.42	70957.07	99304.29	100700.58	140930.28	141917.61	12
49	70484.06	70936.57	99362.08	100642.01	140971.00	141876.05	11
50	70504.69	70916.07	99419.91	100583.47	141011.77	141834.54	10
51	70525.32	70895.56	99477.77	100524.97	141052.56	141793.05	9
52	70545.94	70875.04	99535.66	100466.51	141093.40	141751.61	8
53	70566.55	70854.51	99593.58	100408.07	141134.27	141710.20	7
54	70587.16	70833.98	99651.54	100349.68	141175.17	141668.83	6
55	70607.96	70813.45	99709.53	100291.81	141216.11	141627.49	5
56	70628.35	70792.91	99767.56	100232.98	141257.09	141586.19	4
57	70648.94	70772.36	99825.62	100174.69	141298.10	141544.93	3
58	70669.53	70751.80	99883.71	100116.42	141339.15	141503.70	2
59	70690.11	70731.24	99941.84	100058.19	141380.24	141462.51	1
60	70710.68	70710.68	100000.00	100000.00	141421.36	141421.36	0
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GEOMETRIÆ TRIANGULORUM LIBER III.

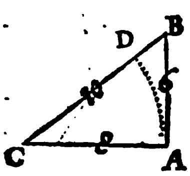
De Rectilineorum Triangulorum Calculo.

1.

CANON Triangulorum compositus, facilem rectilineorum, Sphæricorumque Triangulorum Calculum suppeditat.

Hæc est tertia pars Triangulorum Geometriæ: Canonis Triangulorum compositi usum ostendens, eumque duplicem. Primum in rectilineorum Triangulorum: Alterum in Sphæricorum Triangulorum Calculo.

2. Triangulum rectilineum, est figura in planicie, tribus rectis lineis, quæ finibus suis se mutuo contingunt, conformata.



Talis est figura A B C: *est enim conformata in planicie, tribus rectis lineis* A B, A C *&* B C, *quæ finibus suis se mutuo contingunt.*

3. Triangulum rectilineum, rectangulum est, aut obliquangulum.

4. Triangulum rectilineum rectangulum est, quod angulum habet rectũ.

Tale est in figura superiori Triangulum A B C: *habet enim angulum rectum ad* A.

5. Anguli rectilinei amplitudinem determinat comprehensus ab eo arcus, qui super vertice anguli ipsius velut centro describitur.

Sic in figura præmissa arcus A D, *descriptus centro* C, *mensurat amplitudinem anguli* B C A.

6. In Triangulo rectangulo quadratum basis est æquale quadratis laterum.

Basis Trianguli rectanguli vocatur recta linea quæ angulum rectum subtendit: reliquæ verò rectum ambientes, latera dicuntur. Itaque in Triangulo superiori A B C, *quadratum basis* B C, *est æquale quadratis laterum* B A *&* C A: *cujus ratio ex penultima primi element. manifesta est.*

ΠΟΡΙΣΜΑΤΑ *duo.*

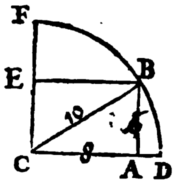
Itaque lateribus trianguli rectanguli cognitis, invenitur & basis: collecta enim in unam summam laterum quadrata, componunt quadratum basis, cujus radix quadrata est ipsa basis quæsita.

In exemplo sit latus A B 6; *& quadratum ejus* 36: A C 8, *& quadratum* 64; *erit* B C 10. *Juncta enim simul quadrata* 36 *&* 64, *componunt quadratum* 100; *cujus radix quadrata est* 10, *pro* B C *basi quæsita.*

Data vero basi cum latere alterutro, manifestatur & reliquum latus: subducto enim quadrato lateris dati, ex quadrato basis, relinquitur quadratum reliqui lateris; cujus radix quadrata est mensura lateris quæsiti.

In exemplo præmisso, deme quadratum lateris A C 64, *ex quadrato basis* B C 100: *relinquitur quadratum lateris* A B 36; *& radix ejus* 6, *pro ipso latere, ut supra. Item deme quadratum lateris* A B 36, *ex quadrato basis* B C 100: *residuum erit quadratum lateris* A C 64; *& radix quadrata ejus* 8, *pro ipso latere postulato.*

7. Si Trianguli rectanguli basis assumatur ut circuli radius, latera sinus recti sunt oppositorum angulorum.



Esto enim Triangulum rectangulum A B C, *in quo* B C *basis assumatur ut circuli radius. Dico* B A *esse sinum rectum anguli* B C A; *&* A C *sinum rectum anguli* A B C. *Recta enim* B A *est perpendicularis à termino arcus* B *in semidiametrum* D A C. *Itaque per 7 primi hujus, Sinus rectus est arcus* D B *vel anguli* B C A *per 5 hujus. Eadem ratione recta* B E, *est sinus rectus arcus* E B, *vel anguli* B C E. *Atqui per 34 primi,* A C *æquatur* B E; *& angulus* A B C, *æquatur angulo* B C E: *ergo* A C, *sinus est anguli* A B C *oppositi.*

ΠΟΡΙΣΜΑΤΑ *quatuor.*

Primo itaque data basi cum angulis inveniuntur latera. Nam ut radius se habet ad sinum anguli; ita basis ad latus ipsi angulo oppositum.

Exempli gratia, Sit basis B C *partium* 10, *& angulus* B C A *partium* 36 52′ 11″, *&* A B C *prioris complementi partium* 53 7′ 49″, *Sinus autem* A B 6000000, *&* A C 8000000, *in ea mensura, in qua radius* B C *est* 10000000. *Invenientur latera* AB 6, *&* AC 8. *Nam per 19 Septimi Euclidis,*

Vt B C 10000000, *ad* A B 6000000: *Ita* B C 10, *ad* A B 6. *Item*
Vt B C 10000000, *ad* A C 8000000: *Ita* B C 10, *ad* A C 8.

Secundo, data basi cum latere alterutro, manifestantur anguli. Basis enim est ad latus datum: ut radius ad sinum anguli dicto lateri oppositi.

In eodem exemplo, datur B C 10, *&* A B 6: *Invenietur angulus* A C B *partium* 36 52′ 11″. *Nam per 19 Septimi Euclidis.*

Vt B C 10, *ad* A B 6: *Ita* B C 10000000, *ad* A B 6000000, *sinum partium* 36 52′ 11″, *competentem angulo* A C B. *Itaque* A B C *reliquus angulus, est partium* 53 7′ 49″: *prioris scilicet complementum, ut ex 7 hujus, & 32 primi elementorum manifestum est.*

Tertio, dato latere alterutro, cum angulis, investigatur latus reliquum. Sinus enim anguli dato lateri oppositi, est ad sinum complementi sui: ut latus datum, ad latus reliquum.

Detur in eodem exemplo angulus A C B *partium* 36 52′ 11″, *& sinus ejus* 6000000: A B C *partium* 53 7′ 49″, *& sinus ejus* 8000000, *cum latere* A B 6; *Dabitur* A C *reliquum latus* 8. *Nam per 19 Septimi Euclidis,*

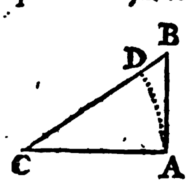
Vt A B 6000000, *ad* A C 8000000: *Ita* A B 6, *ad* A C 8.

Quarto, datis angulis, & latere alterutro, addiscitur basis: Sinus enim anguli dato lateri oppositi, est ad radium: ut latus datum ad Basin.

Repetito & hic superiori exemplo, Detur A B 6, *& angulus ei oppositus* B C A *partium* 36 52′ 11″, *cum sinu ejus* 6000000. *Invenietur basis* B C *partium* 10. *Nam per 19 Septimi Euclidis,*

Vt A B 6000000, *ad* B C 10000000: *Ita* A B 6, *ad* B C 10.

8. Si Trianguli rectanguli latus alterutrum, ex acuto angulo, fiat circuli radius; reliquum est ejusdem anguli Tangens.



Esto rectangulum Triangulum A B C, *cujus latus* A C *fiat circuli radius ex acuto angulo* C. *Dico* A B, *tangentem esse anguli* A C B, *vel arcus* A D.: *est enim perpendicularis extremo semidiametri* A, *in radium* C D *per arcus terminum* D *continuatum. Itaque per 14 Primi hujus, dicti anguli, vel arcus, Tangens est.*

ΠΟΡΙΣΜΑΤΑ *duo.*

Primo igitur, dato latere alterutro cum angulis, invenitur reliquum latus. Radius enim est ad tangentem anguli lateri quæsito oppositi: ut latus datum ad latus reliquum.

Exempli gratia detur latus A B 6: *& angulus* A B C *part.* 53 7′ 49″, *fiatque* A B *radius: erit* A C *Tangens anguli* A B C *ex Canone Tangentium* 13333333 *paulo plus; & latus* A C *reliquum* 8. *Nam per 19 Septimi Euclidis,*

Vt A B 10000000, *ad* A C 13333333 *paulo plus: Ita* A B 6, *ad* A C 8, *Omnino ut supra.*

Se-

Secundo, dato utroque latere, investigantur anguli. Nam ut latus alterum est ad latus reliquum; ita radius ad tangentem anguli reliquo lateri oppositi.

In exemplo detur latus A B 6: *& reliquum latus* A C 8. *Invenietur angulus* A B C *lateri* A C *oppositi, partium* 53 7' 49". *Nam per* 19 *Septimi Euclidis,*

Vt A B 6, *ad* A C 8: *Ita* A B 10000000, *ad* A C 13333333 *paulo plus, Tangentem anguli* A C B, *oppositi lateri* A C; *qui ex Tangentium Canone invenitur partium* 53 7' 49". *Ergo reliquus angulus* B C A *est partium* 36 52' 11".

9. Si Trianguli rectanguli latus alterutrum est anguli tangens, basis est anguli ejusdem secans.

Repetita præmissi Theorematis figura, Sit A B *latus, Tangens anguli* B C A. *Dico Basim* B D C *esse ejusdem anguli Secantem: est enim ducta per terminum peripheriæ* A D *in Tangentem* A B. *Itaque per* 19 *primi hujus, Secans est peripheriæ* A D, *vel anguli* B C A.

ΠΟΡΙΣΜΑΤΑ *tria.*

Primo ergo, dato latere alterutro, cum angulis, manifestatur basis. Radius enim est ad secantem anguli dati: ut latus eidem angulo adjacens ad Basin.

Exempli loco detur latus A C 8; *& angulus* B C A *Dato lateri adjacens, partium* 36 52' 11": *secans ejus* 12500000, *erit Basis* B C 10. *Nam per* 19 *Septimi Euclidis,*

Vt A C 10000000, *ad* B C 12500000: *Ita* A C 8, *ad* B C 10.

Secundo, dato latere alterutro & Basi, exquiruntur anguli. Nam ut latus alterutrum ad Basim: ita radius est ad secantem anguli lateri dato adjacentis.

In exemplo eodem, detur latus A C 8, *& basis* B C 10: *erit angulus* B C A *partium* 36 52' 11". *Nam per* 19 *Septimi Euclidis,*

Vt A C 8, *ad* B C 10: *Ita* A C 10000000, *ad* B C 12500000, *Secantem anguli* B C A, *lateri dato* A C *adjacentis. Inveniturque ex Canone secantium partium* 36 52' 11": *ergo reliquus* A B C, *est partium* 53 7' 49".

Tertio datis angulis & Basi, inveniuntur latera. Nam secans anguli dati est ad radium: ut basis ad latus dato angulo adjacens.

Sit iterum exempli loco angulus B C A *partium* 36 52' 11", *& Secans ejus è Canone Secantium* 12500000: *Basis* B C 10; *erit* A C *latus angulo dato adjacens* 8. *Nam per* 19 *Septimi Euclidis,*

Vt B C 12500000, *ad* A C 10000000: *Ita* B C 10, *ad* A C 8.

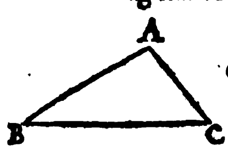
Rursus detur Secans anguli A B C *partium* 53. 7'. 49". 16666666: *& basis* B C 10; *erit* A B 6. *Nam per* 19 *Septimi Euclidis,*

Vt B C 16666666, *ad* A B 10000000: *Ita* B C 10, *ad* A B 6.

Et sic Triangulorum Rectangulorum Calculum absolvimus. Sequitur

Obliquangulorum Triangulorum Calculus.

10. Triangulum rectilineum obliquangulum est, cujus tres anguli obliqui sunt.



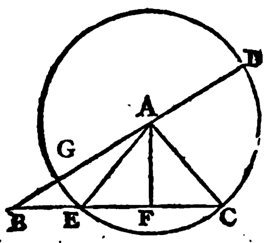
Tale est in adjuncto schemate triangulum A B C, *ejus enim anguli omnes obliqui sunt.*

11. Obliquus angulus est qui acutus est aut obtusus.

12. Acutus angulus est qui recto minor est: obtusus qui recto major.

Ita in superiori figura angulus ad B *&* C *est acutus, est enim uterque recto minor: angulus verò ad* A *obtusus est, quia recto major est.*

13. Si trianguli obliquanguli latus minus fiat circuli radius, & ex ejus angulari puncto describatur circulus, basin & latus majus secans; erit basis ad summam laterum, ut segmentum lateris ad segmentum basis.



Basis trianguli obliquanguli vocatur latus majus: vel, si æquicrurum sit, alterutrum crurum pro basi assumptum. Sit ergo A B C *Triangulum obliquangulum, cujus latus minus* A C; *basis* B C: *facto autem* A C *radio, ex* A *puncto angulari, describatur circuli peripheria, secans basim in* E, *reliquum latus in* G. *Dico basim* B C, *esse ad summam laterum* B A *&* A C *vel* A D (A C *enim &* A D *radii sunt, & proinde æquales per* 15 *Definitionem primi elementorum) ut* B G *lateris segmentum, ad* B E *segmentum Basis. Recta enim* B D *&* B C *à* B *puncto extra circulum producta secant circulum in* G *&* E. *Itaque per* 36 *Tertii elementorum, ut* B C *ad* B D: *Ita* B G *ad* B E. *quod erat demonstrandum.*

ΠΟΡΙΣΜΑ.

Itaque tribus obliquanguli Trianguli lateribus datis, inveniuntur tres anguli. Nam ut basis trianguli ad summam laterum, ita laterum differentia ad basis segmentum: sed ut basis segmentum cum semisse residui, est ad latus majus; ita radius ad secantem anguli lateri minori adjacentis. Item ut semissis residui, est ad latus minus: ita radius ad secantem anguli lateri minori adjacentis. Dantur ergo duo anguli: quibus ex semicirculo subductis, relinquitur tertius basi oppositus.

Retenta præcedentis Trianguli figura sit basis B C 28. *Latera vero* B A 25, A C 17: *& eorum summa* B D 42; *Differentia* B G 8: *erit* B E *segmentum Basis* 12. *Nam,*

Vt B C 28, *ad* B D 42: *Ita* B G 8, *ad* B E 12.

Subductum vero segmentum B E 12, *ex basi* B C 28: *relinquit* E C 16; *cujus semissis* E F *vel* F C *est* 8 (*Perpendicularis enim* A F *bisecat* E C. *per tertiam tertii elementorum) hinc dantur anguli ad* B *&* C *per* 8 *hujus. Nam* B E *est* 12, *&* E F 8: *ergo tota* B F 20. *Basis autem* B A *Trianguli rectanguli* B F A *est* 25. *Itaque*

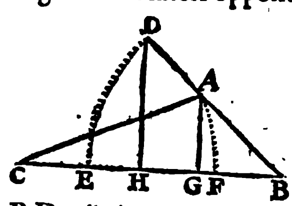
Vt B F 20, *ad* B A 25: *Ita* B F 10000000, *ad* B A 12500000, *secantem anguli ad* B *partium* 36 52′ 11″. *Rursus in Triangulo* A F C *rectangulo datur latus* F C 8, *& basis* A C 17: *ergo*

Vt F C 8, *ad* A C 17: *Ita* F C 10000000, *ad* A C 21250000, *secantem anguli ad* C *partium* 61 55′ 39″.

Iam cum anguli ad C *&* B *noti sint, non potest latêre reliquus ad* A: *est enim residuus duorum ad semicirculum, per* 32 *primi elementorum. Dempto igitur utroque ex semicirculi partibus* 180: *relinquitur ipse angulus quæsitus, partium* 81 12′ 10″.

Atque ita ex tribus obliquanguli Trianguli lateribus datis, tres anguli inventi sunt: quod erat ostendendum.

14. In Triangulo obliquangulo proportio lateris ad latus est: ut proportio sinus recti anguli alteri lateri oppositi, ad sinum rectum anguli reliquo lateri oppositi; & contra.



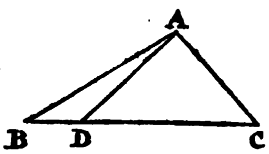
Sit Triangulum A B C *obliquangulum, laterum inæqualium (nam si latera æqualia sint, anguli oppositi per* 5 *primi element. æquantur: itaque & sinus eorum æquales sunt per* 29 *tertii Element.) Dico* B A *latus esse, ad* A C *latus: ut sinus rectus anguli* A C B, *ad sinum rectum anguli* A B C. *Continuetur enim* B A *latus in* D, *ut æquale sit lateri* A C: *descriptisque peripheriis* D E *&* A F *æqualibus radiis* C A *&* B D, *dimittantur ex* D *&* A *arcuum terminis perpendiculares in basim* B C; *suntque* D H *&* A G *sinus recti scilicet angulorum* C *&* B, *vel arcuum* A F *&* D H *per* 7 *primi hujus. Erit per* 4 *sexti elementorum, ut* B A *ad* B D, *hoc est* A C; *Ita* A G *sinus rectus anguli oppositi, ad* D H *sinum rectum anguli oppositi: quod erat demonstrandum. Conversa hujus Theorematis eodem modo demonstratur. Nam quia* B A *latus unum est ad* B D *latus alterum: ut* A G *sinus anguli* C *oppositi, ad* D H *sinum anguli oppositi; est etiam, per elementum citatum,* A G *sinus anguli* C, *ad* D H *sinum*

an-

anguli B; *ut oppositum latus* A B, *ad oppositum latus* D H, *id est*, B C. *Quod etiam demonstrandum erat. Observa autem hoc Theorema verum esse non modo in omnibus rectilineis Triangulis, sed & Sphaericis, quemadmodum suo loco demonstrabitur.*

ΠΟΡΙΣΜΑΤΑ *duo.*

Itaque datis duobus obliquanguli Trianguli lateribus, & angulo non ab iis comprehenso obtuso (aut si acuto data anguli specie alteri lateri oppositi) anguli reliqui, & latus tertium invenitur. Nam ut latus alterutrum dato angulo oppositum est ad sinum anguli dati: ita latus alterum, ad sinum anguli oppositi. Dantur ergo duo anguli; quibus ex semicirculo ablatis, relinquitur tertius. quare ut sinus anguli alterutrius noti, ad alterutrum latus oppositum; ita sinus anguli tertii, ad latus tertium.



Detur in Triangulo A B C *obliquangulo, latus* A B 25; A C 17: *& angulus* A B C *non ab iis comprehensus acutus partium* 36 52′ 11″; *cum acuta specie anguli ad* C *ignoti. Invenietur ipse angulus ad* C *partium* 61 55′ 39″. *Nam per* 19 *Septimi Euclidis*,

Vt latus A C 17, *ad sinum anguli* A B C 6000000: *Ita* A B *latus* 25, *ad sinum anguli* A C B 8823529.

Cujus arcus è sinuum Canone datur partium 61 55′ 39″, *quia species anguli acuta est: nam si obtusa esset, angulus existeret partium* 118 4′ 21″. *Quod ut manifestum fiat, ducatur ex* A *recta* A D *in basin* B C, *aequalis* A C: *erit* A D C *Triangulum aequicrurum, & angulus* A D C *per* 5 *primi element. aequalis angulo* A C D; *exterior autem* A D B *per* 13 *ejusdem, erit reliquus ad semicirculum. Quare ut latus* B A *subtendit duplicem angulum*, A D B *obtusum, &* A C B *acutum: Ita etiam sinus inventus, per* 7 *primi hujus est duarum peripheriarum, minoris circuli quadrante, & reliqua ad semiperipheriam. Patet igitur definiendam esse anguli speciem dato angulo acuto existente. Alia vero est ratio, cum angulus obtusus datur: nam tum manifestum est, reliquos Trianguli angulos acutos esse. Duo enim obtusi anguli in Triangulo plano esse nequeunt, cum omnes Trianguli anguli per* 32 *primi element. aequales sint duobus rectis. Itaque species anguli tunc per se data est, nempe acuta.*

Porro cum in Triangulo A B C *duo anguli noti sint*, A B C *&* A C B, *non potest latere tertius* B A C: *est enim per* 32 *primi elementorum, residuus duorum datorum ad semicirculum, partium scilicet* 81 12′ 10″. *Itaque tertium latus inde innotescit. Nam*

Vt sinus anguli A B C 6000000, *ad latus* A C 17: *Ita sinus anguli* B A C 9882353, *ad latus* B C 28. *vel*,

Vt sinus anguli A C B 8823529, *ad latus* A B 25: *Ita sinus anguli* B A C 9882353, *ad latus* B C 28.

Secundo, datis duobus Trianguli obliquanguli angulis, & uno latere, manifestatur angulus tertius, cum reliquis lateribus. Subductis enim duobus angulis datis ex semicirculo, relinquitur tertius. quare ut se habet sinus anguli lateri dato oppositi ad latus datum: ita etiam reliquorum angulorum sinus ad latera opposita.

Sit & hic Triangulum obliquangulum A B C, *cujus duo anguli* A B C 36 52′ 11″; *&* A C B 61 55 39 *dentur; cum latere* B C 28. *Invenietur reliquus angulus* B A C, *cum lateribus* B A *&* A C. *Demptis enim angulis datis ex semicirculo, relinquitur angulus tertius* B A C, *partium* 81 12′ 10″. *Itaque per* 19 *septimi Euclidis*,

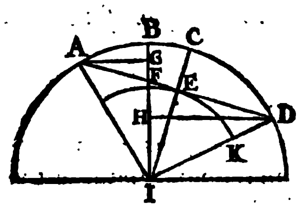
Vt sinus anguli B A C 9882352, *ad latus* B C 28: *Ita sinus anguli* A B C 6000000, *ad latus* A C 17. *Item*

Vt sinus anguli B A C 9882352, *ad latus* B C 28: *Ita sinus anguli* A C B 8823529, *ad latus* A B 25. *vel*

Vt sinus anguli A B C 6000000, *ad latus* A C 17: *Ita sinus anguli* A C B 8823529, *ad latus* A B 25.

15. Si angulorum duorum summa detur, quorum sinuum ratio inter se constet, ipsi etiam anguli secernuntur. Nam ut semissis summae sinuum rationis, ad differentiam semissis, & termini rationis sinuum alterutrius est: ita tangens summae angulorum, ad tangen-

gentem anguli; quo minor quæsitus ab angulorũ summæ semisse deficit; major eam superat.



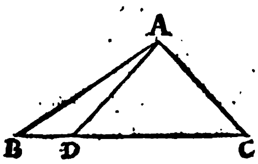
Detur in adjecto diagrammate, summa angulorum A I B *&* B I D *part.* 40 : *cum ratione sinuum ut* A G *ad* D H (*vel per* 4 *sexti elementorum ut* A F *ad* D F) *ut* 4 *ad* 7. *Dico utrumque angulum* A I B *&* B I D *sigillatim datum iri*. *Egrediatur enim ex* I *recta, bisecans* A D, *rationis sinuum summam datam in* E: *erit* A E 5½, *& angulus* A I E *partium* 20, *æqualis angulo* D I E; F E *vero* (*differentia termini minoris* A F 4, *&* A E 5½ *vel* E D 5½ *&* F D *termini majoris* 7) 1½. *Fiat quoque* I E *radius, ut* D E *tangens sit anguli* D I E, *vel arcus* K E *partium* 20: *hinc enim dabitur tangens* E F *angulum* E I F *vel* B I C *subtendens*. *Nam per* 19 *septimi Euclidis*

Vt DE 5½, *ad* DE *tangentem ang.* DIE 3639702: *Ita* FE 1½, *ad* FE *tang. anguli* EIF, 992646.

Cujus arcus è Tangentium Canone datur partium 5 40′ 8″ *fere*. *Atqui hoc angulo major est angulus* B I D *major*: *minor vero angulus* A I B *minor*. *Ergo* B I D *angulus est partium* 25 40′ 8″ *fere*: A I B *partium* 14 19′ 52″: *Quod erat demonstrandum*.

Π Ο Ρ Ι Σ Μ Α.

Itaque duobus obliquanguli Trianguli lateribus datis, & angulo ab iis comprehenso, inveniuntur anguli reliqui, & latus tertium. Nam ut semissis summæ laterum datorum, ad differentiam summæ semissis, & lateris alterutrius: Sic tangens semissis residui anguli ad semicirculum, ad Tangentem anguli, quo angulus minori lateri oppositus eâdem semisse minor, majori major est. Dantur ergo tres anguli. Quare, ut sinus alterutrius anguli, ad latus oppositum: ita sinus anguli quæsito oppositi, ad latus quæsitum.



Retenta superioris Trianguli figura, sit latus A B 25; B C 28: *& angulus* A B C *partium* 36 52′ 11″. *Invenientur reliqui anguli* B A C, *&* A C B *cum tertio latere* A C. *Nam per* 32 *primi elementorum, ex angulo* B *noto, datur summa angulorum* B A C *&* A C B, *partium* 143 7′ 48″, *residuum scilicet anguli dati ad semicirculum: item ex lateribus notis, datur ratio sinuum angulorum oppositorum per* 13 *hujus*. *Itaque cum angulorum duorum summa detur, cum ratione sinuum etiam uterque sigillatim definitur*. *Nam*

Vt semissis summa laterum 26½.	*ad differentiam summa semissis & lateris alterutrius* 1½:
Sic Tangens semissis residui anguli, ad semicirculum partium 71 33′ 54″, *scilicet* 30000000.	*ad Tangentem* 1698112, *anguli partium* 9 38′ 15″, *quo angulus* A C B *minori lateri oppositus semisse residui anguli ad semicirculum minor est*: *reliquus* B A C *majori lateri oppositus major est*. *Itaque* ACB *est part.* 61 55′ 39″, B A C 81 11′ 9″. *ut supra*.

Latus A C *ex præmisso Theoremate invenitur* 17. *Nam*

Vt sinus anguli B A C 9882352 *ad* B C *oppositum latus* 28: *Ita sinus anguli* A B C 6000000, *ad* A C *latus oppositum* 17.

Et sic calculum rectilineorum Triangulorum exposuimus, cujus usus est in omni magnitudinum genere dimetiendo. *Superest tantum ut in eo Mathematum studiosus sedulo se exerceat*. *Theoremata enim sunt pro inventione cujusvis quarti in Triangulo rectilineo datis tribus*, *idque per* 19 *septimi Euclidis*, *i*. *regulam proportionum*.

Etsi vero superior doctrina tam clare proposita sit, ut ulterius explicari non sit opus: *quo tamen promptior & expeditior sit ejus usus*, *subjungimus sequentem diatyposim*, *in qua tanquam in tabula doctrinæ superioris summam exhibemus*.

IN TRIANGULO
RECTANGULO
inveniuntur
LATERA

Ex basi & angulis, *per 7 hujus.*

I	II	III	IIII
Vt radius,	*ad sinum anguli quæsito lateri oppositi*	*Ita Basis,*	*ad Latus quæsitum:*

vel per 9 hujus.

I	II	III	IIII
Vt secans anguli quæsito Lateri adjacens	*ad Radium*	*Ita basis,*	*ad latus quæsitum.*

Ex angulis & latere alterutro, *per 7 hujus.*

I	II	III	IIII
Vt sinus anguli dato lateri oppositi	*ad sinum complementi sui*	*Ita datum Latus,*	*ad Latus reliquum.*

vel per 8 hujus.

I	II	III	IIII
Vt radius	*ad Tangentem anguli dato lateri oppositi*	*Ita datum latus,*	*ad latus reliquum.*

Ex basi & latere alterutro, *per 6 hujus.*

Minue quadratum lateris noti ex quadrato basis, relinquitur quadratum lateris reliqui: cujus tetragonica radix est pro ipso latere quæsito.

BASIS

Ex utroque latere, *per 6 hujus.*

Adde in unam summam quadrata laterum, componitur quadratum Basis: cujus radix quadrata ipsam Basim manifestat.

Ex angulis & alterutro latere, *per 7 hujus.*

I	II	III	IIII
Vt sinus anguli dato lateri oppositi	*ad radium*	*Ita datum Latus,*	*ad basim.*

vel per 9 hujus,

I	II	III	IIII
Vt radius	*ad secantem anguli dato lateri adjacentis*	*Ita datum latus,*	*ad basim.*

ANGULI

Ex basi & latere alterutro, *per 7 hujus.*

I	II	III	IIII
Vt basis	*ad latus datum*	*Ita radius*	*ad sinum anguli dato lateri oppositi.*

vel per 9 hujus,

I	II	III	IIII
Vt latus datum	*ad basin*	*Ita radius*	*ad secantem anguli dato lateri adjacentis.*

Ex utroque crure, *per 8 hujus.*

I	II	III	IIII
Vt latus	*ad latus reliquum*	*Ita radius*	*ad Tangentem anguli reliquo lateri oppositi.*

IN TRIANGULO
OBLIQUANGULO
inveniuntur
ANGULI

Ex tribus lateribus, *per 13 hujus.*

I	II	III	IIII
Vt basis Trianguli	*ad summam laterum*	*Ita laterum differentia*	*ad basis segmentum.*
Vt Basis segmentum cum semisse residui	*ad latus majus*	*Ita radius*	*ad secantem anguli lateri majori adjacentis.*
Vt semissis residui	*ad latus minus*	*Ita radius*	*ad secantem anguli lateri minori adjacentis.*

Dantur jam duo anguli: Tertius est horum duorum residuus ad semicirculum.

LATUS ET ANGULI DUO.

Ex duobus lateribus datis, & uno angulo obtuso non ab iis comprehenso: vel si acuto data specie alterutrius anguli ignoti, *per 14 hujus.*

I	II	III	
Vt latus datum dato angulo oppositum	*ad sinum anguli dati*	*Ita latus alterum*	*ad sinum ang. oppositi minoris quadrante, si species anguli acuta sit, majoris si obtusa.*

Dantur jam duo anguli: Tertius est horum duorum residuus ad semicirculum.

Vt sinus anguli alterutrius noti	*ad latus oppositum*	*Ita sinus anguli tertii*	*ad latus tertium.*

AN-

ANGULUS ET DUO LATERA,

Ex duobus angulis & uno latere, *per eandem*.

Tertius angulus est reliquus duorum datorum ad semicirculum. Itaque,

I	II	III	
Vt sinus anguli dato lateri oppositi	*ad latus datum*	*Ita sinus anguli secundi*	*ad latus oppositum.*
Vt sinus anguli alterutrius	*ad suum latus oppositum*	*Ita sinus anguli tertii*	*ad latus tertium.*

ANGULI DUO ET LATUS

Ex duobus lateribus & angulo ab iis comprehenso, *per* 15 *hujus*.

I	II
Vt semißis summa laterum data	*ad differentiam summa semißis & lateris alterutrius:*

III	
Ita Tangens semißis residui anguli ad semicirculum	*ad Tangentem anguli, quo angulus lateri minori oppositus semisse dicti residui anguli ad semicirculum minor est: oppositus majori major est.*

I	II	III	IIII
Vt anguli alterutrius sinus	*ad latus oppositum*	*Ita sinus anguli quæsito lateri oppositi*	*ad latus quæsitum.*

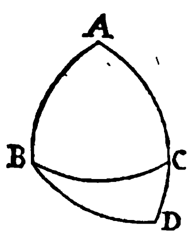
GEOMETRIÆ TRIANGULORUM LIBER IIII.

De Calculo Triangulorum Sphæricorum.

I.

CANONIS Triangulorum compositi usus alter est, in Calculo Triangulorum Sphæricorum.

Superioris libri Theoremate primo, duplex nobis usus Triangulorum Canonis indicatus est: prior in rectilineorum, posterior in Sphæricorum Triangulorum Calculo. Prioris vero ratio præmisso tractatu nobis fuse explicata est: Posterioris demonstratio hoc libro continetur.



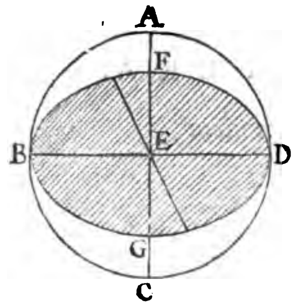
2. Triangulum Sphæricum, est figura in sphærica superficie, trium maximorum Sphæræ arcuum concursu, conformata.

Talis est in adjecto schemate, figura A B C, *vel* A B D.

3. Maximi Sphæræ circuli sunt quibus unum Sphæræ centrum commune est.

4. Si maximus Sphæræ circulus transeat per maximi polos, ipsi normalis est: & contra.

Maximus circulus A B C D, *transeat per maximi circuli* B G D F *polos* A *&* D: *dico circulum*



A B C D, normalem esse circulo B G D F. Ducatur enim per centrum Sphæræ E, recta B E D, ad communem intersectionem planorum B & D: secetque eam alia recta A E C normaliter per centrum E, & polos A & C; erit hæc per 4 undecimi Euclidis plano circuli A B C D normalis. Itaque per 18 ejusdem, planum circuli A B C D, .i. ipse circulus A B C D: est normalis plano circuli B G D F, .i. ipsi circulo B G D F; quod erat demonstrandum. Conversa ex eadem demonstratione perspicua est. Diameter enim B E D, secat axin A E D in E centro normaliter, per 4 undecimi Euclidis: puncta autem A & D, sunt poli circuli B G D F, ex poli definitione; per quos necessario transit circulus A B C D, per conversam decimaoctavæ undecimi elementorum. Itaque maximus Sphæræ circulus A B C D, maximo B G D F normalis, transit per polos ejus: quod erat demonstrandum.

ΠΟΡΙΣΜΑΤΑ *duo.*

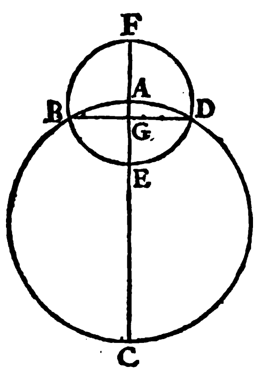
Itaque demissus à polo circuli maximi, in circumferentiam suam arcus, dictæ circumferentiæ normalis est.

Sit enim in figura superiori A B arcus maximi circulus, demissus in circumferentiam B G D F à polo ejusdem A: erit eidem normalis. Nam cum arcus A B, transeat A polum circuli B G D F, vel saltem in eo desinat, consequitur eidem normalem esse.

Punctum vero concursus duorum arcuum maximi circuli, vel unius quadrantis terminus, normaliter è circulo maximo eductorum, est ejusdem circuli polus.

Sic in eodem diagrammate, A punctum concursus duorum arcuum B A & D A, eductorum normaliter è circulo maximo B G D F: vel A, terminus quadrantis B A vel D A ex eodem circulo normaliter educti, est ejusdem circuli polus. Nam cum B A & D A sigillatim circulo B G D F normales sint ex thesi, necesse per polos transeant, vel in polo concurrunt: & proinde punctum concursus arcuum B A & D A, vel terminus quadrantis alterutrius, est circuli B G D F polus.

5. Si maximus Sphæræ circulus, transeat per minoris circuli polum, eidem normalis est.

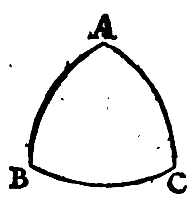


Maximus Sphæræ circulus A B C D, transeat per A polum circuli minoris B E D F: dico maximum minori normalem esse. Maximi enim circuli diameter A E C, est normalis diametro minoris B G D per 3 tertii elementorum. Itaque & circulus maximus A B C D, minimo B E D F normalis per 18 undecimi Euclidis: quod erat demonstrandum.

6. Triangulum Sphæricũ, rectangulum est, aut obliquangulũ.

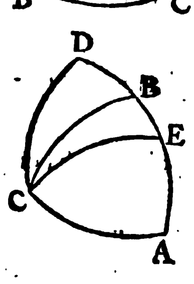
7. Rectangulum est quod angulum habet rectum.

8. Anguli amplitudinem in Sphærico Triangulo, mensurat arcus maximi circuli, ex angulo tanquam polo descriptus dictum angulum subtendens.



Ita in adjuncta Diagrapha, arcus B C, mensurat angulum B A C: est enim arcus magni circuli, ex angulo A, tanquam polo descriptus, ipsum angulũ subtendens.

9. Si Trianguli rectanguli latus alterum, sit quadrans circuli, oppositus angulus rectus est; si quadrante majus, obtusus; si minus, acutus; & contra.

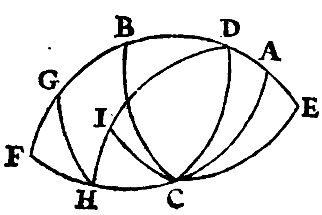


Latus rectanguli Trianguli alterum, vocamus arcuum alterutrum qui rectum angulum continent. Esto igitur Triangulum Sphæricum A B C, rectangulum ad A: Sitque A B latus circuli quadrans. Dico angulum B C A oppositum, rectum esse. Nam per secundum porisma quarti hujus, B est polus circumferentiæ C A: per quem transit arcus B C. Itaque per primum porisma ejusdem, arcus B C est normalis circumferentiæ C A: & proinde angulus ad C rectus. Fiat vero A D latus quadrante majus, & arcus A B circuli quadrans: erit angulus B C A rectus, per primam hujus Theorematis partem; & proinde D C A obtusus

ſus (angulus enim D C A *, major eſt angulo* B C A*) tandem ſtatuatur latus* A E *quadrante minus, & arcus* A B *circuli quadrans: erit angulus* B C A *rectus per primam partem hujus, major angulo* E C A *; & proinde angulus* E C A *acutus eſt.*

Converſa eadem ratione demonſtratur. ſint enim in eodem Triangulo, anguli B C A*, &* B A C *recti: erunt oppoſita latera* B A*, &* B C*, circuli quadrantes. Arcus enim* B A*, &* B C*, egredientes normaliter ex peripheria circuli maximi* C A*, concurrunt in* B*, ejuſdem polo, per ſecundum poriſma quarti hujus: ideoque quadrantes ſunt maximorum circulorum. Simili ratione demonſtratur* D A*, latus, majus eſſe circuli quadrante, ſi angulus ad* C *obtuſus ſit; minus, ſi acutus. Nam ſi angulus* D C A *conſtituatur obtuſus, erit* B C A *rectus, & proinde latus* D A *majus latere* B A *circuli quadrante: ſin* E C A *conſtituatur acutus, erit* B C A *rectus; & proinde* E A *minus* B A *quadrante: quod erat oſtendendum.*

10. Si trianguli rectanguli latus alterum ſit quadrans circuli, etiam baſis quadrans eſt: ſi vero utrumque latus quadrante circuli majus ſit, aut minus, baſis quadrante minor eſt; quod ſi latus unum circuli quadrante majus ſit, reliquum minus, baſis quadrante major eſt: & contra.



Theorematis hujus partes tres ſunt. Prima, baſin Trianguli rectanguli eſſe quadrantem circuli, ſi latus alterum ſit circuli quadrans; & contra. Eſto igitur Sphæricum Triangulum A B C*, rectangulum ad* A*: ſitque latus* A B *circuli quadrans. Dico* B C *baſin etiam circuli quadrantem eſſe. Nam per præmiſſum Theorema, angulus ad* C *rectus eſt: & proinde arcus* A B *&* C B*, normaliter egrediuntur ex* C A *circumferentia, concurrunt autem in* B *polo. Itaque per 2 poriſma quarti hujus, maximorum circulorũ quadrantes ſunt.*

Converſa hujus partis perſpicua eſt. Sit enim angulus ad A *rectus, &* B C *circuli quadrans. Dico alterutrum laterum etiam circuli quadrantem eſſe: polo enim* B*, deſcribatur maximus circulus, ſecturus circumferentiam* B A *in* A*; vel ſupra* A *in* D*; infra in* E*: ſi ſecet in* A*, conſtat* B A *latus quadrantem eſſe per ſecundum poriſma quarti hujus. Si vero in* D*, aut* E *punctis, anguli ad* D *&* E *recti ſunt per primum poriſma ejuſdem: angulus autem ad* A *rectus eſt ex Theſi; quare per ſecundum poriſma ejuſdem,* C *eſt polus circumferentiæ* B D A E*, & latus* C A *circuli quadrans.*

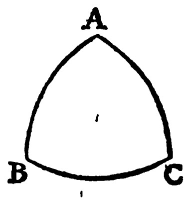
Secunda hujus Theorematis pars eſt: Baſin quadrante minorem eſſe, ſi utrumque Trianguli rectanguli latus, quadrante majus ſit, aut minus: & contra. Aſſumatur igitur & hic Triangulum A B C*, rectangulum ad* A*: continuenturque latera* A B *&* A C*, in* F *oppoſitum polum; componentur duo Triangula,* A B C*, &* F B C*, invicem æqualia. Ducto vero arcu* G H*, per puncta* G *&* H*: fiet* G H *baſis, communis Triangulo* G A H *rectangulo, habenti latera* A G *&* A H*, quadrante circuli* A B*, vel* A C*, majora; Itemque Triangulo* G F H *rectangulo reliquo habenti latera* F G *&* F H *quadrante circuli* F B *vel* F C *minora; baſis vero* G H *erit minor* B C *quadrante circuli: rectos angulos ad* F*, &* A*, per 8 hujus menſurante. Secus enim ſi non ſit, vel major erit* B C *arcu, vel æqualis ipſi. Sed major eſſe nequit: quia Triangulum* A B C*, ad omnes angulos rectangulum, non poteſt capere latus recto majus. Æqualis eſſe nequit, quia neutrius Trianguli latus circuli quadrans eſt: conſequitur igitur baſin* G H*, quadrante minorem eſſe.*

Converſa hujus partis etiam facilis eſt. Sit enim baſis quadrante minor: dico utrumque latus Trianguli rectanguli dati, quadrante majus, aut minus eſſe. Nam ſi non ſit; unum quadrans eſt; vel unum quadrante majus, & reliquum minus. Atqui ſi unum latus quadrans ſit: eſt & baſis quadrans. Vel ſi unum latus quadrante majus ſit, reliquum minus: baſis quadrante major eſt. Vtrumque eſt contra Theſin. Ergo utrumque latus, vel quadrante majus, vel minus eſt. Prioris ratio ex prima hujus Theorematis parte clara eſt: poſterioris ex tertia: quæ docet,

Baſin quadrante circuli majorem eſſe, ſi unum rectanguli Trianguli latus ſit quadrante circuli majus, reliquum minus: & contra. Aſſumatur enim & hic Triangulum D A H*, rectangulum ad* A*: cujus latus* A D*, ſit minus* A B *circuli quadrante; & reliquum* A H*, majus* A C *circuli quadrante. Dico* D H *baſin, etiam quadrante circuli majorem eſſe: & contra. Arcus enim* A C*, eſt circuli quadrans ex fabrica: quemadmodum &* D C *per ſecundum poriſma quarti hujus. Quare ſi polo* D*, in* C *deſcribatur arcus maximi circuli* C I*; ſecabit* D H *baſin in* I*, proinde* D I *quadrans erit, per citatum poriſma, &* D H *quadrante major.*

Conversa hujus partis similiter patet; latus alterum Trianguli rectanguli quadrante majus esse, reliquum minus, si basis quadrante major sit. Secus enim si non sit: erunt latera vel circuli quadrantes; & tunc basis est quadrans, per primam hujus Theorematis partem: vel utrumq; latus erit majus quadrante, vel minus, & tum basis quadrante minor est, per secundam hujus Theorematis partem. Sed utrumque est contra Thesin. Itaque latus unum quadrante majus, reliquum minus est: quæ fuere demonstranda.

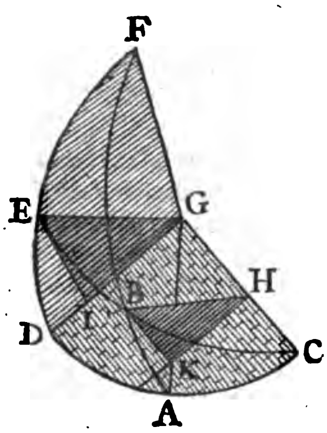
11. Si Trianguli rectanguli alteruter angulorum in basi rectus sit, basis est circuli quadrans; sin uterque vel acutus vel obtusus sit, basis est quadrante minor: si vero alter eorum acutus sit, & reliquus obtusus, basis quadrante major est: & contra.



Sit Triangulum A B C *rectangulum ad* C. *Dico* A B *basin, circuli quadrantem esse, si alteruter angulorum in basi,* A, *aut* B *rectus sit: quadrante minorem si uterque vel acutus, vel obtusus sit; majorem, si alter acutus, reliquus obtusus sit: & contra. Si enim alteruter angulorum* A, *vel* B *rectus sit: alterutrum laterum circuli quadrans est per* 9 *hujus; ergo per* 10 *ejusdem, basis* A B *etiam circuli quadrans est. Sin uterque angulus* A *&* B *similiter acutus sit, aut obtusus: utrumque latus* A C, *&* C B, *per nonam hujus, quadrante majus, vel minus est; ergo per* 10 *ejusdem, basis* A B *quadrante minor est. Quod si alteruter angulorum* A *&* B *acutus sit, reliquus obtusus: per* 9 *hujus, alterutrum laterum quadrante circuli minus, reliquum majus est; ergo per* 10 *ejusdem basis* A B *quadrante major est.*

Conversa similiter probatur. sit enim basis A B *circuli quadrans, alteruter angulorum* A *aut* B *rectus est: Nam per decimam hujus latus alterutrum quadrans circuli est, ergo per* 9 *ejusdem angulus alter rectus est. Si vero* A B *basis quadrante minor sit: uterque angulus* A *&* B *vel acutus, vel obtusus est; nam per* 10 *hujus utrumque latus vel majus est vel minus quadrante. Ergo per* 9 *ejusdem, uterque angulus vel acutus vel obtusus est. Demum si* A B *basis quadrante major sit, alteruter angulorum* A, *aut* B *acutus est, reliquus obtusus. Nam per* 10 *hujus, latus unum quadrante minus, reliquum majus est: ergo per* 9 *ejusdem, angulus alter acutus, reliquus obtusus est; quæ fuerunt ostendenda.*

12. Si quadrans maximi circuli, ad quadrantem maximi inclinatus fuerit, & ab inclinato perpendiculares duo descendant, quorum alter utriusque quadrantis terminum secet: sinus recti segmentorum quadrantis inclinati, ab inclinationis angulari puncto, perpendicularium rectis sinibus proportionales sunt.



Esto C B E *maximi circuli quadrans, inclinatus ad* C A D *maximi circuli quadrantem; & ab* C B E *inclinato, descendant duo arcus* E D *&* B A: *quorum alter* E D, *secet* E *&* D *terminum utriusque quadrantis* C B E *&* C A D. *Dico rectas* B H *&* E G, *sinus rectos segmentorum* C B, *&* C E, *proportionales esse rectis* B K *&* E I, *rectis sinibus perpendicularium arcuum* B A *&* E D. *Triangula enim* G I E *&* H K B, *sunt æquiangula ob rectos angulos ad* I, *&* K, *per* 7 *primi hujus; & similem ad* G *&* H, *inclinationis scilicet superficiei quadrantis* G E C, *ad superficiem quadrantis* G D C *ang. Itaque per quartum sexti elementorum, latera quæ subter æquales eos angulos sunt,* B H *&* E G: *Item* B K *&* E I, *sunt proportionalia; quod erat demonstrandum.*

ΠΟΡΙΣΜΑΤΑ *octo.*

Primo itaque, in rectangulo Triangulo, unicum rectum habente, ex data basi, & angulo alterutro obliquo, invenitur latus oppositum. Radius enim est ad sinum basis: ut sinus anguli ad sinum lateris oppositi. Vel, Radius est ad secantem complementi basis; ut secans complementi anguli ad secantem complementi lateris oppositi. Vel sinus basis est ad radium; ut secans complementi anguli, ad secantem complementi lateris oppositi. Vel secans complementi basis est ad radium: ut sinus anguli ad sinum lateris oppositi.

Esto in præcedenti Diagrapha, A B C *Triangulum rectangulum, unicum rectum habens ad* A *per primum porisma quarti hujus: deturque* B C *basis ejus, partium* 60; *& angulus* A C B *part.* 30. *Invenietur* A B *latus oppositum partium* 25 39′ 32″. *Nam per quartam sexti elementorũ, &* 19 *septimi,*

Vt E G

Vt E G *radius* 10000000	*ad* B H *sinum basis* B C 8660254	*Ita* E I *sinus arcus* E D *vel anguli* ACB *per* 8 *hujus* 5000000, *ad*	B K *sinum lateris oppositi* B A 4330127 *partium* 25 39' 32".

Ergo latus A B *est partium* 25 39' 32": *quadrante minus per* 9 *hujus*, *quia angulus oppositus* A C B *acutus est*.

Demonstratum vero est 20 *Theoremate primi hujus*, *sinum rectum peripheria ad radium esse*: *ut radius ad secantem complementi*. *Itemque*, *secantes peripheriarum*, *complementorum suorum rectis sinibus proportionales esse*. *Itaque per secundum porisma Theorematis citati*,

Vt radius 10000000	*ad secantem complem. basis* B C 11547004	*Ita secans compl. anguli dati* 20000000 *ad*	*secantem complem. lateris oppositi* A B 23094008 *par.* 64 20' 28".

Quare latus A B *est partium* 25 39 32 *ut supra*.

Aliter per primum porisma Theorematis citati,

Vt sinus basis 8660254, *ad*	*Radium* 10000000	*Ita secans complem. ang. dati* 20000000, *ad*	*secantem compl. lateris oppositi* A B 23094008.

Aliter per secundum porisma ejusdem,

Vt secans comp. basis 11547004 *ad*	*Radium* 10000000	*Ita sinus anguli dati* 5000000, *ad*	*Sinum lateris oppositi* AB 4330127.

Secundo, data basi, & latere alterutro, exquiritur angulus oppositus. Nam ut sinus basis est ad radium; ita sinus lateris dati ad sinum anguli oppositi. Vel, ut secans complementi basis est ad radium; ita secans complementi lateris, ad secantem complementi anguli oppositi. Aut, ut radius est ad sinum basis; ita secans complementi lateris, ad secantem complementi anguli oppositi. Aut, ut radius est ad secantem complementi basis: ita sinus lateris, ad sinum anguli oppositi.

Retento superiori Triangulo A B C, *sit basis* B C *partium* 60: *&* *latus* A B *partium* 25 39' 32. *Invenietur angulus* A C B *oppositus*, *partium* 30. *Nam per quartam sexti &* 19 *septimi Euclidis*,

Vt B H *sinus basis* B C 8660254	*ad* E G *radium* 10000000, *ita*	B K *sinus lateris* A B 4330127, *est ad*	E I *sinum arcus* E D *vel anguli* A C B 5000000.

Angulus itaque A C B *quæsitus est partium* 30: *acutus per* 9 *hujus*, *quia latus oppositum est minus circuli quadrante*.

Aliter per secundum porisma 20 *primi hujus*,

Vt secans compl. basis 11547004 *ad*	*Radium* 10000000, *ita*	*Secans compl. lateris dati* 23094008 *ad*	*Secantem compl. ang. oppositi* 20000000, *partium* 60.

Itaque ipse angulus est partium 30.

Aliter per primum porisma ejusdem,

Vt radius 10000000	*ad sinum basis* 8660254, *ita*	*Secans complem. lateris dati* 23094008, *ad*	*Secantem complem. anguli oppositi* 20000000.

Ali-

Aliter per ſecundum poriſma ejuſdem,

Vt radius 10000000 } *ad ſecantem complem. baſis* 11547004, *ita* { *Sinus lateris dati* 4330127, *ad* } *Sinum anguli oppoſiti* 5000000 *partium* 30.

Tertio, dato latere & angulo huic oppoſito, inveſtigatur baſis, ſi conſtiterit quadrantene major ſit an minor. Nam ut ſinus anguli eſt ad radium; ita ſinus lateris, ad ſinum baſis. Aut, ut ſecans complementi anguli eſt ad radium; ita ſecans complementi lateris, ad ſecantem complementi baſis. Vel, ut radius eſt ad ſinum anguli; ita ſecans complementi lateris eſt, ad ſecantem complementi baſis. Aut, ut radius eſt ad ſecantem complementi anguli: ita ſinus lateris ad ſinum baſis.

Aſſumpto & hic ſuperiori Triangulo, detur latus A B *partium* 25 39′ 32″: *& angulus* B C A *oppoſitus partium* 30; *erit* B C *baſis part.* 60. *ſi fuerit quadrante minor: vel* 120 *ſi major. Nam per* 4 *ſexti, &* 19 *ſept. Euclidis,*

Vt E I *ſinus angul.* E C D 5000000 *ad* } E G *radium* 10000000 { *Ita* B K *ſinus lateris* A B *dati* 4330127 } *ad* B H *ſinum baſis* B C 8660254 *minorem quadrante partium* 60.

Aut per ſecundum poriſma 20 *primi hujus,*

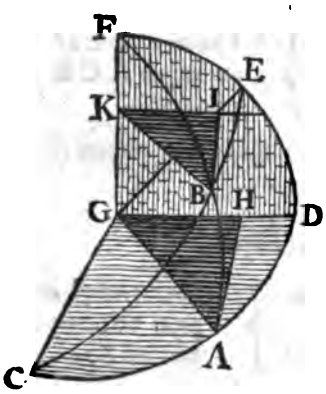
Vt ſecans complem. ang. 20000000 } *ad radium* 10000000 { *Ita ſecans compl. lateris dati* 23094008, *ad* } *Secantem complemen. baſis* 11547004 *part.* 30. *ergo baſis eſt partium* 60.

Vel per primum poriſma ejuſdem,

Vt radius 10000000 *ad* } *Sinum ang. dati* 5000000 { *Ita ſecans compl. lateris dati* 23094008, *ad* } *Secantem complem. baſis* 11547004.

Vel per ſecundum poriſma citatæ,

Vt radius 10000000 *ad* } *Secantem complem. ang.* 20000000, *ita* { *Sinus lateris dati* 433012 } *ad ſinum baſis* 8660254 *ut ſupra.*



Quarto, dato latere alterutro & baſi, innoteſcit latus reliquum: ſinus enim complementi lateris dati eſt ad radium; ut ſinus complementi baſis, ad ſinum complementi lateris reliqui. Vel, ſecans lateris dati eſt ad radium; ut ſecans baſis ad ſecantem reliqui lateris. Vel, radius eſt ad ſinum complementi lateris; ut ſecans baſis ad ſecantem lateris alterius. Vel, radius eſt ad ſecantem lateris; ut ſinus complementi baſis, ad ſinum complementi lateris reliqui.

Sit & hic Trianguli A B C, *latus* A B *partium* 25 39′ 32″: *&* B C *baſis partium* 60. *Invenietur reliquum latus* AC, *partium* 56, 18′, 35″. *Nam per quartam ſexti, &* 19 *ſeptimi Euclidis,*

Vt B K *ſinus arcus* F B, *comple. lateris* A B *dati* 9013880 } *ad* A G *radium* 10000000, *ita* { B I *ſinus arcus* BE, *.i. compl. baſis* BC 5000000, } *ad* A H *ſinũ arcus* A D *com. lat.* AC 5547002 *partium* 33 41 25.

Itaque A C *latus eſt partium* 56 18′ 35″, *quadrante minus per* 10 *hujus, quia baſis cum reliquo latere ſigillatim quadrante minor eſt.*

Ali-

Aliter per 2 porisma vicesimæ primi hujus,

Vt secans lateris dati 11094005 } *ad radium* 10000000 { *Ita secans basis* 20000000 } *ad secantem reliqui lateris* 18027760 *partium* 56 18′ 35″.

Vel per primum porisma ejusdem,

Vt radius 10000000 } *ad sinum complem. lateris dati* 9013880 { *Ita secans basis* 20000000 } *ad secantem reliqui lateris* 18027760.

Vel per secundum porisma ejusdem,

Vt radius 10000000 } *ad secantem lateris dati* 11094005 { *Ita sinus complem. basis* 5000000 } *ad sinum complem. lateris quæsito* 5547002.

Quinto, dato utroque latere investigatur basis. Nam, ut radius est ad sinum complementi lateris alterutrius: ita sinus complementi lateris reliqui, est ad sinum complementi basis. Vel, radius est ad secantem lateris alterutrius, ut secans lateris reliqui ad secantem basis. Vel, sinus complementi lateris alterutrius est ad radium; ut secans lateris reliqui, ad secantem basis. Vel secans lateris alterutrius est ad radium; ut sinus complementi lateris reliqui, ad sinum complementi basis.

Detur in Triangulo A B C, *latus* A B *partium* 25 39′ 32″: *&* A C *reliquum latus partium* 56 18′ 35″. *invenietur basis* B C *partium* 60. *Nam per* 4 *sexti, &* 19 *septimi Euclidis,*

Vt AG *radius* 10000000 } *ad* B K *sinum arcus* F B *.i. compl. lateris* A B 9013880 { *Ita* AH *sinus arcus* D A *.i. compl. later.* D C 5547002 } *ad* BI *sinum arcus* EB *.i. complem. bas.* B C 5000000 *part.* 30.

Ergo basis B C *est partium* 60, *minor circuli quadrante per* 10 *hujus, quia utrumque latus sigillatim quadrante minus est.*

Aliter per secundum porisma 20 *primi hujus,*

Vt radius 10000000 } *ad secantem lateris* A B 11094005 { *Ita secans lateris* A C 18027760 } *ad secantē basis* 20000000, *part.* 60.

Vel per primum porisma ejusdem,

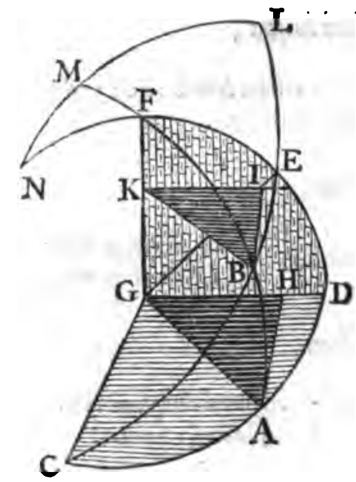
Vt sinus complem. lat. A B 9013880 } *ad radium* 10000000 { *Ita secans reliqui lateris* 18027760 } *ad secantem basis* 20000000.

Vel per secundum porisma ejusdem,

Vt secans lat. A B 11094005 } *ad radium* 10000000 { *Ita sinus complem. lateris reliqui* 5547002 } *ad sinum complem. basis* 5000000.

Sexto, dato latere & angulo adjacente, innotescit obliquus alter. Radius enim est ad sinum complementi lateris: ut sinus anguli, ad sinum complementi reliqui. Aut, radius est ad secantem lateris dati; ut secans complementi anguli, ad secantem anguli reliqui. Aut, sinus complementi lateris dati est ad radium; ut secans complementi anguli, ad secantem reliqui. Aut, secans lateris dati est ad radium; ut sinus anguli, ad sinum complementi reliqui.

Repetita postrema Trianguli nostri figura, detur latus A C *partium* 56 18′ 35″: *angulusque ei adjacens* A C B *partium* 30. *Invenietur reliquus obliquus* A B C, *part.* 73 53′ 52″ *& paulo plus.*



Continuentur enim arcus, B E *in* L; B F *in* M: *&* E F *in* N; *ut* B L, B M, *&* E N, *quadrantes sint maximorum circulorum. Facto vero* N *polo, describatur maximi circuli quadrans* N M L, *per terminos quadrantum* B M, *&* B L. *Manifestum est angulum ad* M, *in Triangulo* N M F *rectum esse, per primum porisma quarti hujus: & basin* F N, *complementum esse arcus* F E; *& proinde aequalem arcui* E D. *Item angulum ad* F, *aequalem esse angulo* A F D, *vel arcui* A D, *complemento scilicet lateris* A C. *Quare cum in eodem Triangulo* N M F *rectangulo, detur basis* F N, *aequalis angulo* A C B: *& angulus ad* F *aequalis complemento lateris* A C; *dabitur etiam oppositum angulo latus* N M, *complementum scilicet arcus* M L, *angulum ad* B *quaesitum subtendentis. Nam per primum porisma hujus,*

Vt radius 10000000	*ad basim* F N *.i. sinū ang.* A C B 5000000	*Ita ang.* M F N *.i. sinus comp. lat.* A C 5547002	*ad* M N *.i. sinū comp. anguli ad* B, 2773501 *partium* 16 6′ 8″ *fere.*

Ergo angul. A B C *est partium* 73 53′ 52″; *acutus per* 9 *hujus, quia oppositum ei latus* A C *quadrante minus est.*

Aliter per 2 porisma 20 primi hujus,

Vt radius 10000000	*ad secantem complem. ang. dati* 20000000	*Ita secans lateris dati* 18027760	*ad secantem angul. reliqui* 36055520 *part.* 73 53′ 52″, *ut supra.*

Vel per primum porisma ejusdem,

Vt sinus anguli dati 5000000	*ad radium* 10000000	*Ita secans lateris dati* 18027760	*ad secantem anguli reliqui* 36055520.

Vel per secundum porisma ejusdem,

Vt secans comp. ang. dati 20000000	*ad radium* 10000000	*Ita sinus compl. lateris dati* 5547002	*ad sinum compl. anguli reliqui* 2773501

Septimo, dato latere, & angulo opposito; datur obliquus reliquus, si species ejus nota sit. Sinus enim complementi lateris dati est ad radium; ut sinus complementi anguli dati ad sinum reliqui. Vel, secans lateris dati est ad radium; ut secans anguli dati, ad secantem complementi reliqui. Vel, radius est ad sinum complementi lateris dati: ut secans anguli dati, ad secantem complementi reliqui. Vel, radius est ad secantem lateris; ut sinus complementi anguli dati, ad sinum reliqui.

Detur in Triangulo A B C *latus* A B *partium* 25 39′ 32″: *& angulus ei oppositus* A C B *partium* 30; *cum specie reliqui ad* B *acuta. Invenietur ipse angulus ad* B *partium* 73 53′ 52″. *Nam in Triangulo* F M N *rectangulo, datur latus* F M, *aequale lateri* A B: *& basis* N F *aequalis arcui* D E, *.i. angulo* A C B. *Ergo & reliquum latus* N M, *.i. complementum arcus* M L, *vel anguli ad* B, *per quartum porisma hujus innotescit. Nam,*

Vt sinus com. M F *.i.* A B *lat. dati* 9013880	*ad radium* 10000000	*Ita sinus comp. basis* N F *.i. ang. dati* 8660254	*ad sinum* M L *.i. ang. ad* B 9607690 *part.* 73 53 52, *acuti ex thesi.*

Vel

Vel per secundum porisma 20 primi hujus,

Vt secans A B *lateris dati* 11094005	*ad radium* 10000000	*Ita secans ang.* A C B *dati* 11547004	*ad secantem complementi angul. reliqui* 10408330 *partium* 16 6′ 8″.

Ergo ipse angulus est partium 73 53′ 52″.

Vel per primum porisma ejusdem,

Vt radius 10000000	*ad sinum compl. lateris dati* 9013880	*Ita secans anguli* ACB 11547004	*ad secantem compl. ang. reliqui* 10408330.

Vel per secundum porisma 20 primi hujus,

Vt radius 10000000	*ad secantem lateris* A B 11094005	*Ita sinus complem. ang.* A C B *dati* 8660254	*ad sinum anguli reliqui* 9607690

Postremo, dato utroque angulo obliquo, datur etiam latus alterutrum. Sinus enim anguli unius, se habet ad radium; ut sinus complementi reliqui, ad sinum complementi lateris oppositi. Aut, secans complementi anguli unius est ad radium; ut secans alterius, ad secantem lateris oppositi. Vel, radius est ad sinum anguli alterutrius; ut secans anguli reliqui, ad secantem lateris oppositi. Vel, radius est ad secantem complementi anguli unius; ut sinus complementi alterius, ad sinum complementi lateris oppositi.

Manente postremo diagrammate, detur in Triangulo A B C *rectangulo, uterque obliquus angulus ad* B *&* C: *dabitur etiam alterutrum latus. Nam in Triangulo* M F N *rectangulo, datur latus* M N, *complementum arcus* L M, *subtendentis angulum ad* B: *& basis* N F, *complementum scilicet arcus* F E, *.i. arcus* E D, *subtendens angulum ad* C. *Ergo & angulus ad* F *oppositus, .i. arcus* D A, *vel complementum lateris* A C *invenietur. Nam per 2 porisma hujus,*

Vt sinus basis F N *.i. ang. ad* C, 5000000	*ad radium* 10000000	*Ita sinus lateris* M N *.i. complem. ang. ad* B 2773501	*ad* M F N *sinum ang. oppositi .i. complem. lateris* A C 5547002 *partium* 16 6′ 8″, *fere*.

Ergo ipsum latus A C *est partium* 73 53′ 52″ *paulo plus: quadrante minus per 9 hujus, quia angulus oppositus acutus est.*

Aliter per 2 porisma 20 primi hujus,

Vt secans compl. anguli ad C 20000000	*ad radium* 10000000	*Ita secans ang. reliqui ad* B 36055520,	*ad secantem lateris oppositi,* 18027760, *par.* 73 53′ 52″ *paulo plus, ut supra.*

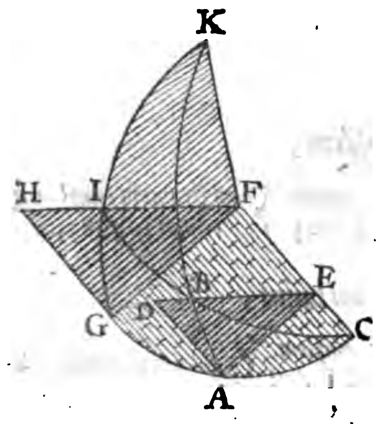
Vel per primum porisma 20 primi hujus,

Vt radius 10000000	*ad sinum ang. ad* C 5000000	*Ita secans ang. ad* B 36055520	*ad secantem lateris oppositi* 18027760.

Vel per secundum porisma ejusdem,

Vt radius 10000000	*ad secantem complem. ang. ad* C 20000000	*Ita sinus compl. anguli reliqui* 2773501	*ad sinum compl. lateris oppositi* 5547002.

13. Si quadrans maximi circuli, quadrantem maximi ſecet, & à ſecante, duo arcus perpendiculares ſecto ducantur; quorum alter per utriuſque quadrantis terminum tranſeat; ſinus recti ſegmentorum quadrantis ſecti, à puncto ſectionis, perpendicularium tangentibus proportionales ſunt.



Maximi circuli quadrans I B C, *ſecet* G A C *quadrantem maximi in* C: *& ab* I B C *ſecante, deſcendant perpendiculares arcus duo*, I G *&* B A; *quorum alter* I G, *tranſeat per terminum utriuſque quadrantis* I *&* G. *Dico ſinus rectos* G F *&* A E, *ſegmentorum* C I *&* C A: *proportionales eſſe tangentibus* H G, *&* D A, *perpendicularium* I G *&* B A. *Triangula enim* H G F, *&* D A E, *ſunt æquiangula: ob rectos angulos ad* G *&* A, *per 15 primi hujus; Communem ad* F *&* E, *inclinationis ſcilicet angulum ſuperficiei quadrantis ſecantis, ad ſuperficiem quadrantis ſecti. Itaque per quartam ſexti elementorum ſunt laterum proportionalium. Quare ut* G F, *ad* A E: *Ita* H G *ad* D A, *quod erat demonſtrandum*.

ΠΟΡΙΣΜΑΤΑ octo.

Primo, igitur in rectangulo Triangulo, dato latere & angulo adjacente, inveſtigatur latus reliquum. Radius enim eſt ad ſinum lateris dati; ut tangens anguli adjacentis, ad tangentem reliqui lateris. Vel, radius eſt ad ſecantem complementi lateris: ut tangens complementi anguli adjacentis, ad tangentem complementi lateris alterius. Vel, ſinus lateris dati eſt ad radium: ut tangens complementi anguli adjacentis, ad tangentem complementi lateris reliqui. Vel ſecans complementi lateris dati, eſt ad radium: ut tangens anguli adjacentis, ad tangentem reliqui lateris.

Aſſumpto & hic Triangulo A B C *rectangulo, detur latus* A C *partium* 56 18′ 35″: *& angulus adjacens ad* C *partium* 30. *invenietur reliquum latus* A B, *part.* 25 39′ 32″. *Nam per 4 ſexti & 19 ſeptim. Euclidis*,

Vt G F *radius* 10000000	*ad* A E *ſinum lateris* A C 8320482	*Ita* G H *tangens arcus* I G *i. ang. ad* C; 5773502	*ad* A D *tangentem later.* A B 4803831 *part.* 25 39′ 32″. *quadrant. minoris per 9 hujus quia ang. oppoſ. acutus eſt*.

Demonſtratum vero eſt 20 Theoremate primi hujus, ſecantes arcuum, complementorum ſuorum rectis ſinibus: itemque 17 ejuſdem, tangentes arcuum complementorum ſuorum tangentibus proportionales eſſe. Itaque ſi loco ſinuum, tangentiumque peripheriarum datarum, aſſumantur complementorum ſecantes & tangentes, manebit eadem proportio. Quare,

Vt radius 10000000	*ad ſecantē comp. lateris dati* 12018535	*Ita tangens comp. anguli ad* C 17320508	*ad tang. compl. lateris oppoſiti* A B 20816713 *partium* 64 20′ 28″.

Ergo ipſum latus eſt partium 25 39′ 32″.

Vel, quia radius media proportione eſt ad tangentes peripheriæ & complementi, per 17 primi hujus,

Sinus lateris A C 8320482	*eſt ad radium* 10000000	*ut tangens comp. anguli dati* 17320508	*ad tangent. complementi lateris* A B *oppoſiti* 20816713.

Vel,

Secans complem. Lateris A C 12018535	*eſt ad radium* 10000000	*ut tangens anguli ad* C 5773502	*ad tangent. lateris* A B *oppoſiti* 4803831.

Se-

Secundo, dato latere & angulo opposito, exquiritur reliquum latus, si constiterit quadrantene majus sit an minus. Nam ut tangens anguli dati est ad radium: ita tangens lateris oppositi, ad sinum anguli reliqui. Vel, ut tangens complementi anguli noti, ad radium est: ita tangens complementi lateris oppositi, ad secantem complementi lateris alterius. Vel, ut radius ad tangentem anguli dati; ita tangens complementi alterius lateris, ad secantem complementi lateris oppositi. Vel, ut radius ad tangentem complementi anguli dati: ita tangens lateris oppositi, ad sinum lateris reliqui.

Manente figura superioris Trianguli, sit latus A B *part.* 25 39′ 32″: *& angulus ad* C *oppositus partium* 30; *dabitur reliquum latus* A C *partium* 56 18′ 35″. *Nam per* 4 *sexti &* 19 *septimi Euclidis*,

Vt G H *tangen. arcus* I G. *i. ang. ad* C 5773502	*ad* G F *radium* 10000000	*Ita* A D *tang. lateris* A B *oppositi* 4803831	*ad* A E *sinum lateris reliqui* A C 8320482. *part.* 56 18′ 35″ *si minus quadrante sit, partium vero* 123 41′ 25″, *si majus sit.*

Vel per 17 *&* 20 *primi hujus*,

Vt tangens comp. anguli ad C 17320508	*ad radium* 10000000	*Ita tangens complem. later. oppositi* A B 20816713	*ad secantem compl. later.* A C 12018535. *par.* 33 41 25.

Ergo si ipsum latus quadrante minus est, partium est 56 18′ 35″.

Vel per 17 *primi hujus*,

Vt radius 10000000	*ad tangen. ang. ad* C 5773502	*Ita tang. comp. late. oppositi* A B 20816713	*ad secan. com. lateris* A C 12018535.

Vel,

Vt radius 10000000	*ad tangentem compl. anguli ad* C 17320508	*Ita tangens later. oppositi* A B 4803831	*ad sinum lateris reliqui* A C 8320482.

Tertio, dato utroque latere, datur angulorum obliquorum alteruter, sinus enim lateris alterutrius est ad radium; ut tangens reliqui lateris, ad tangentem anguli oppositi. Aut, secans complementi lateris alterutrius ad radium est: ut tangens complementi alterius lateris, ad tangentem complementi anguli oppositi. Aut, radius est ad sinum lateris alterutrius: ut tangens complementi reliqui lateris, ad tangentem complementi anguli oppositi. Vel, radius est ad secantem complementi lateris unius: ut tangens alterius, ad tangentem anguli oppositi.

Retento superiori Triangulo A B C, *detur latus* A B *part.* 25 39′ 32″: A C *partium* 56 18′ 35″. *invenietur angulus ad* C *partium* 30. *Nam per* 4 *sexti &* 19 *septimi Euclidis*,

Vt A E *sinus Lateris* A C 8320482	*ad* GF *radiũ* 10000000	*Ita* AD *tangens reliqui lateris* A B 4803831	*ad* GH *tangentẽ arc.* IG. *i. ang. ad* C *oppositi* 5773502. *partiũ* 30: *acuti per* 9 *hujus, quia latus oppositũ est quadrante minus.*

Aliter per 17 *&* 20 *primi hujus*,

Vt secans compl. lat. A C 12018535	*ad radium* 10000000	*Ita tangẽs comp. reliqui lateris* A B 20816713	*ad tangentem comp. anguli ad* C *oppositi* 17320508 *par.* 60.

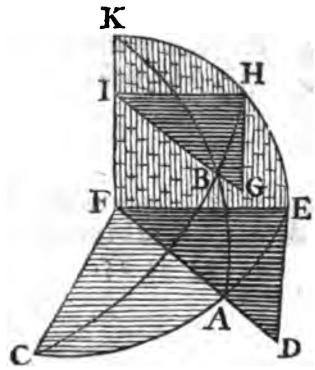
Ergo ipse angulus est partium 30, *ut supra.*

Vel per 17 primi hujus,

Vt radius 10000000	*ad sinum lateris* A C 8320482	*Ita tangens complem. reliqui lateris* A B 20816713	*ad tangentem comp. ang. ad* C *oppositi* 17320508.

Vel per eidem Theorema,

Vt radius 10000000	*ad secantem com. lateris* A C 12018535	*Ita tang. reliqui lat.* A B 4803831	*ad tangentem ang. ad* C *oppositi* 5773502.



Quarto, data basi & angulo, investigatur latus adjacens. Nam ut sinus complementi anguli dati ad radium: ita tangens complementi basis est, ad tangentem complementi lateris dato angulo adjacentis. Vel ut secans anguli dati est ad radium: ita tangens basis, ad tangentem lateris dato angulo adjacentis. Aut, radius est ad sinum complementi anguli dati; ut tangens basis ad tangentem lateris angulo dato adjacentis. Aut, radius est ad secantem anguli dati: ut tangens complementi basis, ad tangentem complementi lateris dato angulo adjacentis.

Assumpto & hic Triangulo A B C *rectangulo, detur basis* B C *part.* 60: *& angulus ad* C *partium* 30. *invenietur latus* A C *part.* 56 18' 35". *Nam per quartam sexti & 19 septimi Euclidis,*

Vt IH *sinus arcus* KH *comp.* HE *.i. ang. ad* C 8660254	*ad* F E *radiū* 10000000	*Ita* HG *tangēs arcus* H B *.i. complementi basis* BC 5773502	*ad* E D *tangentem arcus* E A *.i. compl. lateris* A C 6666665 *.par.* 33 41' 25".

Ergo ipsum latus A C *est partium* 56 18' 35". *quadrante minus per 9 & 10 hujus. Nam propter angulum ad* C *acutum, latus* A B *quadrante minus est: propter basin verò etiam quadrante minorem, reliquum latus* A C *quadrante minus est.*

Vel per 17 & 20 primi hujus,

Vt secans anguli ad C 11547004	*ad radium* 10000000	*Ita tangens basis* 17320508	*ad tangentem lateris* A C *angulo dato adjacentis* 15000000 *partium* 56 18' 35".

Vel per 17 primi hujus,

Vt radius 10000000	*ad sinum com. ang. ad* C 8660254	*Ita tangens basis* 17320508	*ad tangen. lateris* A C *ang. dato adjacentis* 15000000 *partium* 56 18' 35".

Vel,

Vt radius 10000000	*ad secantem anguli ad* C 11547004	*Ita tangens complem. basis* 5773502	*ad tangentē complementi lateris* A C 6666665. *ut supra.*

Quinto, dato latere & angulo adjacente, invenitur basis. Radius enim est ad sinum complementi anguli: ut tangens complementi lateris ad tangentem complementi basis. Aut, radius est ad secantem anguli; ut tangens lateris ad tangentem basis. Vel, sinus complementi anguli est ad radium, ut tangens lateris ad tangentem basis. Vel, secans anguli est ad radium; ut tangens complementi lateris ad tangentem complementi basis.

Ma-

Maneat & hic postremum nostrum diagramma, deturque in Triangulo A B C, *latus* A C *partium* 56 18′ 35″: *angulusque ad* C, *part.* 30. *invenietur basis* B C *partium* 60. *Nam per quartam sexti & decimamnonam septimi Euclidis*,

Vt F E *radius* 10000000	*ad* I H *sinum arcus* KH .*i. complem.* H E, *vel ang. ad* C, 8660254	*Ita tangens* E D .*i. compl. lateris* A C, 6666665	*ad* H G, *tangentem* H B, *complem. basis*, 5773502. *partium* 30.

Ergo basis est partium 60, *quadrante minor per* 10 *hujus, quia utrumque latus singulatim quadrante minus est*: A C *quidem ex thesi*, A B *vero propter angulum ad* C *acutum*.

Vel per 17 *&* 20 *Theorema primi hujus*,

Vt radius 10000000	*ad secantem ang. ad* C 11547004	*Ita tangens lateris* A C 15000000	*ad tangentem basis* 17320508. *pa.* 60.

Vel per 17 *primi hujus*,

Vt sinus compl. ang. ad C 8660254	*ad radium* 10000000	*Ita tangens lateris* A C 15000000	*ad tangentem basis* 17320508, *pa.* 60.

Vel per eidem Theorema,

Vt secans ang. ad C 11547004	*ad radium* 10000000	*Ita tangens complementi lateris* A C 6666665	*ad tangentem complem. basis* 5773502, *ut supra*.

Sexto, data basi & latere, manifestatur angulus adjacens. Tangens enim complementi lateris dati est ad radium; ut tangens complementi basis ad sinum complementi anguli adjacentis. Vel, tangens lateris dati est ad radium; ut tangens basis ad secantem anguli adjacentis. Vel, radius est ad tangentem complementi lateris dati; ut tangens basis ad secantem anguli adjacentis. Vel, radius est ad tangentem lateris dati; ut tangens complementi basis, ad sinum complementi anguli adjacentis.

Repetita & hic superiori Trianguli nostri figura, detur B C *basis partium* 60: *latusque* A C *partium* 56 18 35. *invenietur angulus ad* C *adjacens partium* 30. *Nam per* 4 *sexti &* 19 *septimi Euclidis*,

Vt E D *tangens arcus* E A .*i. comp. lateris* A C 6666665.	*ad* F E *radium* 10000000	*Ita* G H *tangens arcus* H B .*i. compl. basis* B C 5773502	*ad* I H *sinũ arcus* KH .*i. comp.* H E *vel anguli ad* C 8660254, *par.* 60.

Ergo ipse angulus ad C *est partium* 30, *acutus*: *basis enim* C B *est minor quadrante*. *Itaque per* 10 *hujus, utrumque latus* A D *&* B D *est quadrante circuli minus vel majus*. *Sed* A D *unum latus est quadrante minus ex thesi*. *itaque & reliquum* B D: *proinde oppositus angulus ad* A *per* 9 *hujus acutus est*.

Aliter per 17 *&* 20 *primi hujus*,

Vt tangens lateris A C 15000000	*ad radium* 10000000	*Ita tangens basis* 17320508	*ad secantem anguli ad* C *adjacentis* 11547002 *partium* 30.

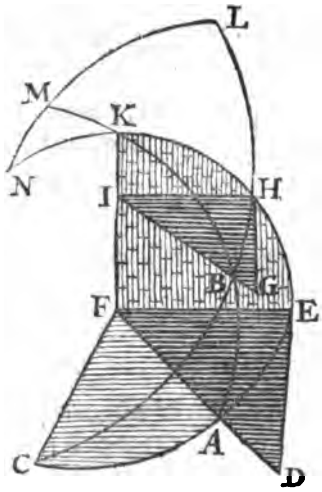
Vel per 17 *primi hujus*,

Vt radius 10000000	*ad tangentem comp. lateris* A C 6666665	*Ita tangens basis* 17320508	*ad secantem ang. ad* C 11547002, *part.* 30.

Vel,

Vt radius 10000000	*ad tangentem lateris* A C 15000000	*Ita tangens comp. basis* 5773502	*ad sinum compl. ang. ad* C 8660254.

Sep-



Septimo, data basi & angulo obliquo alterutro, invenitur reliquus. Nam ut sinus complementi basis est ad radium: ita tangens complementi anguli, ad tangentem anguli reliqui. Aut, ut secans basis est ad radium; ita tangens anguli, ad tangentem complementi reliqui. Vel, ut radius est ad sinum complementi basis; ita tangens anguli, ad tangentem complementi reliqui. Vel, ut radius est ad secantem basis; ita tangens complementi anguli, ad tangentem reliqui.

Detur in Triangulo A B C, *basis* B C *partium* 60: *& angulus ad* C *partium* 30: *dabitur reliquus ad* B *partium* 73 53' 52". *Repetitur enim figura, quæ fuit sexto porismate Theorematis præmissi. Demonstratum fuit, illic, arcum* H L *æqualem esse basi* B C, *& mensuram esse anguli ad* N, *in Triangulo* N M K *rectangulo ad* M: *Item* E H *mensuram anguli ad* C *in Triangulo* A B C, *æqualem esse basi* N K *in Triangulo* N M K; M L *vero arcum, mensuram esse anguli ad* B *quæsiti, &* M N *complementum ejusdem. Quare cum in Triangulo* N M K, *detur angulus ad* N, *cum basi* N K: *dabitur etiam per quartum hujus* NM, *latus angulo adjacens, .i. complementum anguli ad* B *quæsiti. Nam,*

Vt sinus comp. ang. ad N *.i. basis data* 5000000	*ad radium* 10000000	*Ita tangens comp. basis* N K *.i. ang. ad* C 17320508	*ad tangentem comp.* M N *.i. ad tangentem arcus* M L *vel ang. ad* B 34641016 *part.* 73 53' 52" *acuti.*

Nam quia basis quadrante minor est, latera sunt quadrante majora, vel minora similiter per 10 *hujus. Sed* A B *latus quadrante minus est per* 9 *hujus; propter angulum ad* C *oppositum acutum: Ergo & reliquum latus quadrante minus est, & reliquus angulus acutus. Aliter per* 17 *vel* 20 *primi hujus,*

Vt secans basis 20000000	*ad radium* 10000000	*Ita tang. anguli ad* C 5773502	*ad tangentem complementi anguli reliqui* 2886751 *partium* 16 6' 8".

Vel per 17 *primi hujus,*

Vt radius 10000000	*ad sinum compl. basis* 5000000	*Ita tang. ang. ad* C 5773502	*ad tang. compl. anguli reliqui* 2886751.

Vel per idem Theorema,

Vt radius 10000000	*ad secantem basis* 20000000	*Ita tang. compl. ang. ad* C 17320508	*ad tangent. ang. reliqui* 34641016.

Postremo, dato utroque angulo obliquo datur basis. Tangens enim anguli alterutrius est ad radium; ut tangens complementi anguli reliqui, ad sinum complementi basis. Vel, tangens complementi anguli alterutrius est ad radium; ut tangens anguli reliqui ad secantem basis. Aut, radius est ad tangentem anguli alterutrius; ut tangens anguli reliqui ad secantem basis. Aut, radius est ad tangentem complementi anguli alterutrius; ut tangens complementi anguli reliqui ad sinum complementi basis.

Manente superiori diagrapha, detur angulus ad C *part.* 30: *& reliquus ad* B *partium* 73 53' 52". *Dabitur basis* B C *partium* 60. *Assumatur enim & hic Triangulum* N M K *rectangulum: in quo cum detur latus* N M, *complementum scilicet arcus* M L *.i. anguli ad* B; *& basis* N K, *æqualis arcui* H E, *.i. angulo reliquo ad* C, *datur etiam angulus ad* N, *vel arcus* L H *.i. basis* B C. *Nam per* 6 *porisma hujus,*

Vt tangens compl. N M *.i. arcus* ML *vel angul. ad* B, 34641016	*ad radium* 10000000	*Ita tangens comp. basis* N K, *.i. arcus* HE *vel ang. ad* C 17320508	*ad sinum compl. ang. ad* N *.i. arcus* L H *vel basis* BC 5000000 *partium* 30.

Er-

Ergo basis est partium 60, quadrante minor per 11 hujus, quia angulus uterque acutus est.

Aliter per 17 & 20 Theorema primi bujus,

Vt tangens comp. ang. ad B 2886751	*ad radium* 10000000	*Ita tang. ang. ad* C 5773502	*ad secantem basis* 20000000 *partium* 60.

Vel per 17 primi bujus,

Vt radius 10000000	*ad tang. ang. ad* B 34641016	*Ita tangens anguli ad* C 5773502	*ad secantem basis* 20000000

Vel per idem Theorema,

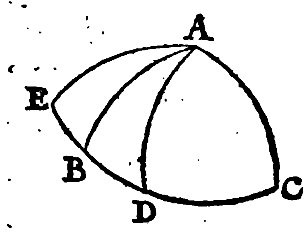
Vt radius 10000000	*ad tang. comp. ang. ad* B 2886751	*Ita tang. comp. ang. ad* C 17320508	*ad sinum comp. basis* 5000000

Atque ita calculus rectangulorum Triangulorum expositus est. Sequitur

Obliquangulorum Sphæricorum Calculus.

14. Triangulum obliquangulum Sphæricum est, cujus tres anguli obliqui sunt.

15. Si triangulum obliquangulum, acutos duos angulos aut obtusos habuerit, perpendicularis arcus, ab angulari puncto tertii egrediens, cadit intra triangulum: sin angulorum alter acutus, & reliquus obtusus extiterit, cadit extra.

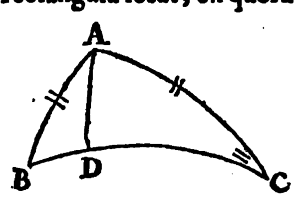


Esto obliquangulum Triangulum A B C, *acutangulum ad* B *&* C: *dico perpendicularem* A D, *demissum ab* A *vertice anguli tertii, cadere intra Triangulum. Nam si non cadit intra: vel lateri alterutri coincidat, vel extra cadat necesse est. Si lateri alterutri coincidat: tunc angulus ad* C, *vel* B *rectus est, quod est contra thesin. Si extra cadit exempli gratia in* E: *angulus ad* E *rectus est. Sed angulus* A B E *obtusus est, reliquus scilicet acuti* A B C. *Itaque per 9 hujus, latus* A E *est majus circuli quadrante. Rursus quia angulus ad* C *acutus est in Triangulo* A E C *rectangulo, per citatum theorema; latus* A E *quadrante minus est. Itaque* A E *latus, commune utrique Triangulo* A E B, *&* A E C, *est quadrante majus & minus; quod absurdum est. Consequitur igitur perpendicularem cadere intra Triangulum datum.*

Esto verò A E B *triangulum, obtusangulum ad* B: *acutangulum ad* E. *Dico* A D *perpendicularem cadere extra Triangulum, in latus* E B *continuatum. Secus si non: vel lateri alterutri coincidit, vel intra cadit. Sed coincidere nequit, quia tunc alteruter angulorum ad* B, *vel* E *rectus esset: Intra cadere nequit, quia uterque angulorum ad* B, *&* E, *acutus esset, vel obtusus, ex prima parte hujus. Vtrumque est contra thesin. Consequitur igitur, perpendicularem extra Triangulum cadere, si alter angulorum acutus, & reliquus obtusus extiterit: quæ fuerunt demonstranda.*

ΠΟΡΙΣΜΑΤΑ *quatuor.*

Primo itaque in Triangulo obliquangulo datis duobus lateribus & angulo uni eorum opposito, insuper nota specie anguli alteri dato lateri oppositi, anguli reliqui latusque tertium inveniuntur. Demissus enim ab angulo datis lateribus contento, in oppositum latus (continuatum si oportet) perpendicularis arcus, obliquangulum Triangulum, in duo rectangula secat, ex quorum calculo quæsita inveniuntur.



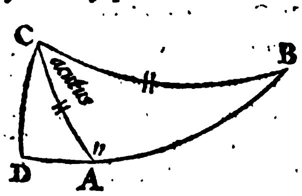
Esto Sphæricum Triangulum A B C *obliquangulum: in quo dentur latera,* A C *part.* 50, A B *part.* 26 22′ 20″, *& angulus ad* C *part.* 30, *cum specie anguli ad* B *acuta; dabuntur anguli ad* A *&* B, *cum tertio latere* B C. *Descendat enim perpendicularis* A D *in latus* B C, *qui intra Triangulum cadit, propter utrumque angulum ad* B *&* C *acutum; fiuntque rectangula Triangula duo,* A D C *&* A D B, *daturque in Triangulo* A D C *basis* A C *part.* 50, *& angulus ad* C *part.* 30. *Itaque per primum porisma duodecimi hujus,* A D *est part.* 22 31′ 15″: *quadrante circuli minus, per 9 hujus, quia oppositus angulus acutus est.*

Iam

Iam si quæratur angulus ad B, *dabitur adminiculo perpendicularis* A D *inventi. Nam in Triangulo* A D B *rectangulo, datur basis* A B *part. 26 22' 20'', & latus* A D *part. 22 31' 15''. Itaque per 2 porisma 12 hujus, angulus ad* B *est part. 59 34' 21'' acutus per 9 hujus, quia oppositum latus quadrante minus est.*

Eodem modo definitur angulus ad A. *Nam in Triangulo* A D B *datur basis* A B *part. 26 22' 20'', & latus* A D *part. 22 31' 15''. Itaque per 6 porisma 13 hujus, angulus* B A D *est part. 33 14' 53'', acutus. Nam quia basis* A B *est minor quadrante, utrumque latus* A D *&* B D, *quadrante minus est, aut majus. Sed* A D *latus minus est quadrante, itaque &* B D. *Quare per 9 hujus, angulus ad* A *oppositus acutus est: Rursus in Triangulo rectangulo* A D C, *datur basis* A C *part. 50, & angulus ad* C *part. 30, & latus* A D *part. 22 31' 15''; Itaque per 7 porisma 12, vel per 6, aut 7 decimitertii (plura enim hic data sunt) angulus* D A C *est part. 69 38' 20'', acutus, quia basis & latus quadrante minor est. Anguli verò* B A D, *&* C A D *æquales sunt angulo* B A C, *ergo angulus* B A C *est part. 102 53' 13''.*

Quin & latus B C *eadem methodo investigatur, In Triangulo enim rectangulo* B A D *datur basis* A B *part. 26 22' 20'', & latus* A D *part. 22 31' 15''. Quare per 4 porisma duodecimi hujus,* B D *est part. 14 5' 44'', quadrante minor per 10 hujus, quia basis cum dato latere sigillatim quadrante minores sunt. Præterea in Triangulo rectangulo* A D C *datur basis* A C *part. 50, angulus ad* C *partium 30, cum latere* A D *part. 22 31' 15''. Quare per 4 porisma 12 hujus, vel per 2 aut 4 decimitertii, latus* D C *est part. 45 54' 16'', quadrante minus, quia basis & latus datum quadrante minus est. Iam cum* B D *sit part. 14 5' 44''; &* D C *part. 45 54' 16'', latus* B D C, *utriusque summa est part. 60.*



Et sic quidem propositi Trianguli postulata innotescunt, perpendiculari intra Triangulum cadente: Diversa autem parum est ratio, perpendiculari cadente extra. Esto enim obliquangulum Triangulum A B C, *in quo detur* A C *latus part. 26 22' 20'',* B C *partium 60, & angulus ad* B *part. 102 53' 13'', cum specie anguli ad* C *acuta: Invenientur reliqui anguli ad* C *&* B, *cum latere tertio* A B. *Emisso enim perpendiculari arcu* C D, *ex angulari puncto datorum laterum* C, *cadente extra, propter angulos ad* A *&* C *specie diversos, fiunt ut supra duo Triangula rectangula* A D C *&* B D C, *ex quorum calculo quæsita inveniuntur. In Triangulo enim* A D C *datur basis* A C *part. 26 22' 20'', cum angulo ad* A *part. 77 6' 47'', reliquo scilicet ipsius* B A C *ad semicirculum; itaque* C D *perpendicularis per primum porisma 12 hujus est part. 25 39' 32''.*

Secundo, in Triangulo B D C *rectangulo datur basis* B C *part. 60, & latus* C D *part. 25 39' 32''; Itaque per secundum porisma 12 hujus, angulus ad* B *est part. 30.*

Tertio, in eodem Triangulo rectangulo B D C, *datur basis* B C *part. 60, cum latere* C D *part. 25 39' 32'', ergo per 6 porisma 13 hujus, angulus* B C D *est part. 73 53' 52''. Item in Triangulo rectangulo* A D C, *datur basis* A C *part. 26 22' 20'', cum latere* C D *part. 25 39' 32''; ergo per idem porisma angulus* A C D *est part. 14 19' 31''. Ablato vero angulo* A C D *ex angulo* B C D, *relinquitur angulus* A C B *partium 59 34' 21''.*

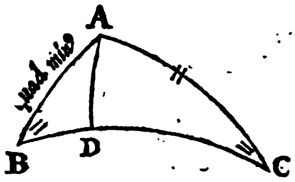
Postremo, in Triangulo rectangulo B D C, *datur basis* B C *part. 60, cum angulo ad* C *part. 73 53' 52'', ergo per primum porisma 12 hujus, latus angulo dato oppositum* B D *est part. 56 18' 35''. Item in Triangulo rectangulo* A D C *datur basis* A C *part. 26 22' 20'', cum angulo ad* C *part. 14 19' 31'', ergo per idem porisma, latus* A D *angulo* C *oppositum est part. 6 18' 35''. Aufer autem* A D *ex* B D, *& relinquitur latus* A B *part. 50. Quæ fuerunt investiganda.*

Secundo, datis duobus angulis, & latere uni eorum opposito, patescunt reliqua latera, & angulus tertius, si modo constiterit utrum latus ignotum dato angulo oppositum, quadrante majus fuerit an minus. Perpendicularis enim arcus eductus à termino lateris dati, in latus utrique angulo dato adjacens, (continuatum si oportet) obliquangulum in duo Triangula rectangula dividit, unde postulata innotescunt.

Detur A B C *triangulum non rectangulum, & in eo latus* A C *part.* 50, *cum angulis, ad* C *quidem part.* 30, *sed ad* B *part.* 59 34' 21'': *sitque* A B *latus ignotum quadrante minus. Innotescent hinc reliqua latera* A B *&* D C, *cum angulo tertio ad* A. *Primum enim in Triangulo rectangulo* A D C *datur basis* A C *part.* 50, *cum ang. ad* C *part.* 30. *Ergo per primum porisma 12 hu-*

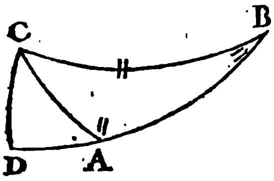
hujus perpendicularis A D est part. 22 31′ 15″: caditque intra Triangulum, quia B & C anguli dati sunt acuti.

Secundo, in Triangulo rectangulo ADB datur latus A D part. 22 31′ 15″, cum opposito angulo B part. 59 34′ 21″; itaque basis A B, per 3 porisma 12 hujus, est part. 26 22′ 20″, quadrante minor ex thesi.



Tertio, in Triangulo A D B rectangulo, ex latere A D part. 22 31′ 15″, & angulo B part. 59 34′ 21″, datur latus B D per idem porisma partium 14 5′ 44″, quadrante minus, propter A B basin quadrante minorem. Item in Triangulo A D C rectangulo, ex latere A D part. 22 31′ 15″, & ang. C part. 30 (vel ex aliis, quia plura data sunt) datur latus D C part. 45 54′ 16″. Summa vero laterum B D & D C, part. 60, æquatur lateri B C.

Postremo, in Triangulo rectangulo A D C, propter datam basim A C, cum latere D C, & angulo C, invenitur angulus D A C partium 69 38′ 20″. Item in Triangulo rectangulo A D B, ex data basi A B, & latere B D, cum angulo B, patescit multis modis ang. B A D part. 33 14′ 53″. Summa vero angulorum D A C & C A D, æqualis est angulo B A C tertio, part. 102 53′ 13″.



Et sic postulata porismatis nostri investigata sunt, perpendiculari arcu cadente intra Triangulum. Similis fere est ratio si cadat extra. Detur enim in apposito Triangulo A B C obliquangulo, angulus ad A part. 102 53′ 13″, ad B part. 30, cum latere B C part. 60; innotescent hinc reliqua latera & angulus tertius.

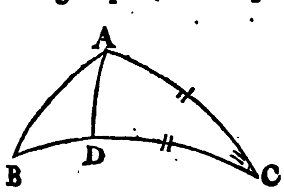
Primum enim, quia perpendicularis C D cadit extra, dantur in Triangulo rectangulo B D C, basis B C partium 60, cum angulo C part. 30. Quare per primum porisma 12 hujus, perpendicularis C D est partium 25 39′ 32″.

Secundo, in Triangulo rectangulo A C D, datur perpendicularis C D part. 25 39′ 32″, cum angulo ad A, residuo scilicet ipsius B A C ad semicirculum part. 77 6′ 47″; Ergo per secundum porisma 13 hujus, angulus A C D est part. 14 19′ 31″. Item in Triangulo rectangulo B C D, datur perpendicularis C D part. 25 39′ 32″, & angulus ad B part. 30. Ergo per idem porisma, vel per alia quia plura data sunt, angulus B C D est part. 73 53′ 52″. Aufer autem angulum A C D ex angulo B C D, & reliquus erit angulus tertius A C B part. 59 34′ 21″.

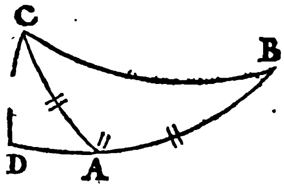
Tertio, in Triangulo rectangulo A D C, ex dato utroque angulo C & A cum latere C D, datur reliquum latus D A part. 6 18′ 35″. Item in Triangulo rectangulo B D C, ex dato utroque angulo B & C, etiam latere C D, & basi B C, multis modis manifestatur latus B D part. 56 18′ 35″. Tolle autem latus D A part. 6 18′ 35″, ex latere B D part. 56 18′ 35″, & remanebit latus A B part. 50.

Postremo, in Triangulo rectangulo A D C ex dato utroque angulo C & A, atque etiam utroque latere C D & A D, variis modis patescit basis A C part. 26 22′ 20″; Quæ fuerunt investiganda.

Tertio, datis duobus lateribus, & angulo ab iis comprehenso, tertium latus, & anguli reliqui innotescunt. Perpendicularis enim arcus, à termino lateris alterutrius dati, in reliquum datum (si necesse sit productum) emissus, opbliquangulum triangulum in duo rectangula partitur, ex quorum calculo ignota manifestantur.



Esto obliquangulum Triangulum A B C, in quo dentur latera A C part. 50, B C part. 60, cum angulo ad C ab iis comprehenso part. 30. Perpendicularis A D ut supra invenitur part. 22 31′ 15″, caditque intra Triangulum, ut calculus docebit. Latus enim C D in Triangulo rectangulo A D C, invenitur per 4 porisma 12 hujus, vel per alia, quia plura data sunt, part. 45 54′ 16″, minus latere BC part. 60. Itaque B D est part. 14 5′ 44″, & perpendicularis A D intra Triangulum cadit. Porro ex lateribus A D & B D in Triangulo rectangulo A D B cognitis, invenitur basis A B, per 5 porisma duodecimi hujus, part. 26 22′ 20″: Item angulus ad B, per tertium porisma decimitertii hujus, vel per alia, quia plura data sunt, partium 59 34′ 21″. Postremo, angulus B A D in eodem Triangulo A D B; invenitur part. 33 14′ 53″; & angulus D A C in Triangulo A D C part. 69 38′ 20″. Ergo angulus B A C utriusque summa est part. 102 53′ 13″.

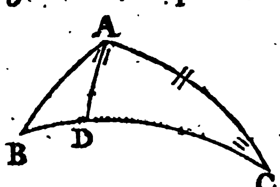


Dentur vero in Triangulo obliquangulo A B C apposito latera, A B partium 50, A C part. 26 22' 20", cum angulo A incluso part. 102 53' 13"; perpendicularis D C erit part. 25 39' 32", ut supra, quadrante minor. Nam angulus C A D est acutus, residuus sc. C A B obtusi, & basis A C est minor quadrante. Itaque perpendicularis arcus C D cadit extra. Dantur autem in Triangulo A D C rectangulo latus C D part. 25 39' 32", & angulus ad A part. 77 6' 47", reliquus, sci. anguli C A B, ad semicirculum: ergo latus D A est part. 6 18' 35". A B vero est part. 50: totus igitur arcus D A B est part. 56 18' 35".

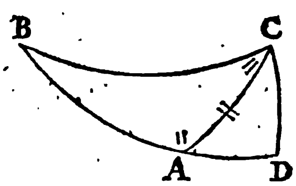
Secundo, in Triangulo B D C rectangulo dantur latera, C D part. 25 39' 32", & D B part. 56 18' 35"; ergo basis B C invenitur part. 60, angulus ad C part. 30, & angulus B C D part. 73 53' 52".

Tandem in Triangulo A D C rectangulo, reperitur angulus A C D partium 14 19' 31", qui subductus ex angulo B C D part. 73 53' 52", relinquit angulum A C B part. 59 34' 21". Quæ fuerunt indaganda.

Postremo datis duobus angulis, una cum latere utrique adjacente, reliqua latera, & angulus tertius investigantur. Perpendicularis enim arcus ab angulo alterutro in oppositum latus (continuatum si oportet) egrediens, obliquangulum Triangulum in duo rectangula secat, ex quorum calculo quæsita dantur.

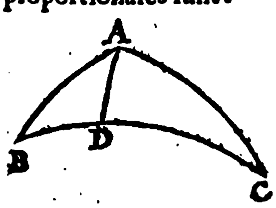


Esto Triangulum A B C non rectangulum, sitque angulus ad A part. 102 53' 13", ad C part. 30, & latus A C part. 50. Erit A D part. 22 31' 15", latus scilicet Trianguli rectanguli A D C: & angulus C A D part. 69 38' 20", minor angulo B A C dato; ergo reliquus B A D est partium 33 14' 53", & proin perpendicularis intra Triangulum cadit. Hinc in Triangulo A D B invenitur latus A B (ex dato latere A D, cum angulo ad A) part. 26 22' 20": item angulus tertius ad B part. 59 34' 21", cum latere B D, part. 14 5' 44". Latus vero D C invenitur in Triangulo A D C, part. 45 54' 16". Ergo totum latus B D C est part. 60.



Sit verò angulus ad A in Triangulo apposito A B C part. 102 53' 13", ad C part. 59 34' 21", & latus A C part. 26 22' 20": invenietur C D perpendicularis part. 25 39' 32", quadrante minor; ergo angulus ad B, in Triangulo rectangulo B D C, per 9 hujus acutus est, & perpendicularis cadit extra; anguli enim ad A & B specie diversi sunt. Hinc reperiuntur, primum in Triangulo A D C, latus D A part. 6 18' 35", & in Triangulo C D B, latus D B part. 56 18' 35". Aufer autem D A ex D B, & reliquum erit latus A B part. 50. Adhuc in eodem triangulo C D B, invenitur angulus tertius ad B part. 30, & latus B C part. 60. Quæ fuerunt indaganda.

16. In obliquangulo Triangulo sinus angulorum sinibus oppositorum laterum directè proportionales sunt.



Esto ut supra obliquangulum Triangulum A B C, sectum per A D perpendicularem, in duo Triangula rectangula A D C & A D B; dico sinum anguli B esse ad sinum lateris oppositi A C, ut sinus anguli C ad sinum oppositi lateris A B. Nam per 7 porisma 12 hujus est,

Vt sinus ang. B, ad sinum lateris A D, ita sinus ang. D, ad sinum lat. A B.

Item ut sinus ang. C ad sinum lateris A D, ita sinus ang. D, ad sinum lateris A C.

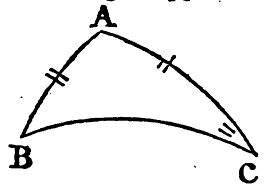
Atqui per 19 Septimi Euclidis, factus à sinu A D in sinum ang. D æquatur facto à sinu B in sinum A B, & facto à sinu C in sinum A C. Itaque per eandem,

Vt sinus ang. B ad sinum oppositi lateris A C, ita sinus ang. C ad sinum oppositi lateris A C. Eademque est ratio in reliquo angulo A, & opposito latere B C. Quod erat demonstrandum.

ΠΟΡΙΣΜΑΤΑ *duo.*

Primum igitur datis duobus lateribus, cum angulo uni datorum laterum opposito, ma-

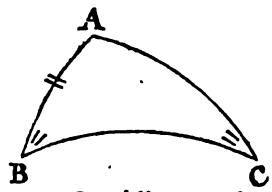
manifestatur angulus, alteri datorum laterum oppositus. Est enim ut sinus lateris dati ad sinum anguli oppositi; ita sinus lateris alterius dati, ad sinum anguli oppositi.



In exemplo dentur in obliquangulo Triangulo A B C *apposito duo latera*, A B *part. 26 22′ 20″*, A C *part. 50, cum angulo ad* C *partium 30. Invenietur angulus ad* B *partium 59 34′ 21″. Nam*

Vt sinus lateris A B *4442009 ad sinum anguli oppositi* C *5000000, ita sinus lateris* B C *7660445 ad sinum anguli oppositi* D *8622725, partium 59 34′ 21″.*

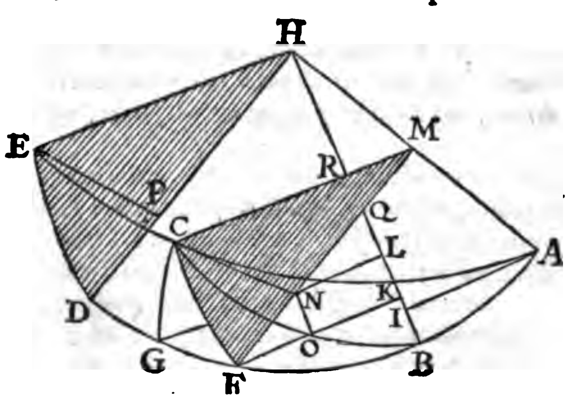
Secundo, datis duobus angulis, cum latere uni datorum angulorum opposito, invenitur latus alteri datorum angulorum oppositus. Nam ut sinus anguli dati ad sinum lateris oppositi, ita sinus alterius anguli dati, ad sinum lateris oppositi.



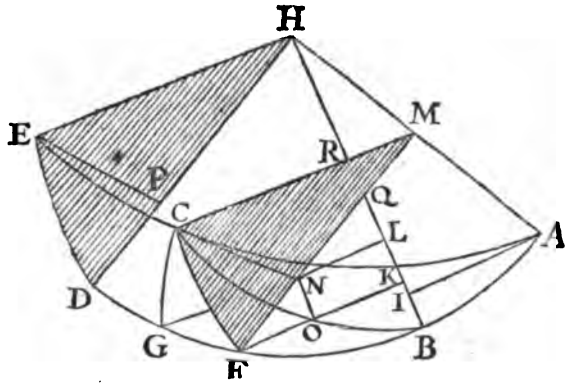
Exempli causa, dentur in Triangulo obliquangulo A B C *duo anguli, unus ad* C *partium 30, alter ad* B *part. 59 34′ 21″, cum latere* A B *part. 26 22′ 20″: Invenietur* A C *latus part. 50. Nam*

Vt sinus anguli C *5000000, ad sinum* A B *lateris oppositi 4442009: Ita sinus anguli* B *8622725, ad sinum* A C *lateris oppositi 7660445 part. 50, ut supra.*

17. In obliquangulo triangulo, quadratum radii est ad planum sinuum rectorum laterum duorum, ut sinus versus anguli ab iisdem comprehensi, ad differentiam sinuum versorum tertii lateris, & reliquorum laterum differentiæ. Quadratum autem radii est ad planum sinuum rectorum angulorum duorum, ut sinus versus lateris, utrique angulo adjacentis, ad differentiam sinuum versorum tertii anguli, & differentiæ datorum angulorum unius, & alterius ad semicirculum complementi.



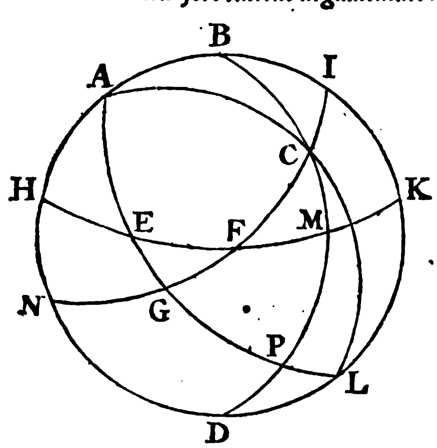
Hoc Theorema verum est in omni Triangulo, tum rectangulo, tum obliquangulo, verum quia usus ejus potissimum est in Triangulis obliquangulis, ideo hic de obliquangulis κατ' ἐξοχὴν enumeratur. Sit igitur Sphæricum Triangulum A B C *obliquangulum, cujus latera* A B *&* A C *inæqualia, & sigillatim quadrante circuli minora, producantur in* E *&* D, *ut* A C E *&* A B D *quadrantes sint maximorum circulorum. Facto verò* A *polo, describatur arcus* D E *intervallo* A D; *& arcus* C F *intervallo* A F; *erit tunc arcus* D E *per* 8 *hujus mensura anguli ad* A; *arcus verò* A F *æqualis erit arcui* A C. *Item polo* B, *& distantiâ* B C *describatur arcus* C G, *qui æqualis erit arcui* B C; *& proinde arcus* B F *differentia erit laterum* A C *&* A B, *& arcus* G F *differentia tertii lateris* B C, *& reliquorum laterum differentiæ* B F. *Emittantur deinde ex* H *communi centro quadrantum* A D *&* A F, *semidiametri* H A, H B, *&* H D, *in puncta* A, B, D; *& à terminis arcuum* A B, B F, *&* B G, *demittantur perpendiculares* A I, F K, *&* G L, *in semidiametrum* H B; *erunt hæ arcuum dictorum recti sinus, per* 7 *primi hujus*; B I *autem*, B K, *&* B L, *versi sinus eorundem per* 10 *ejusdem: & proinde* K L *differentia sinuum versorum lateris* B C *vel* B G, *& reliquorum laterum differentiæ* B F. *Præterea à termino arcus* A F *descendat perpendicularis* F M *in semidiametrum* H A, *erit hæc sinus rectus lateris* A F. *Vbi autem* G L *&* F M *sese intersecant fit* N *punctum, ex quo ducatur* N O *parallela* H B; *adeoque per* 34 *primi elementorum æqualis ipsi* K L. *Adhæc à termino arcus* D E, *demittatur perpendicularis* E P *in semidiametrum* H D, *erit hæc sinus rectus arcus* D E; *&* D P *sinus versus ejusdem. Postremò à communi termino arcuum* F C *&* G C *ducatur recta* C N *in* N, *sectionem rectarum* G L *&* F M; *erit hæc normalis rectis* G N *&* F N. *Arcus enim* F C *&* G C *per* 5 *hujus normales sunt quadranti* A B D, *transeunti per* A *&* B *polos eorundem. Itaque communis eorum sectio, quæ per* 3 *undecimi Euclidis est recta linea, nempe* C N, *est plano quadrantis* A B D *normalis per* 19 *ejusdem. Transit autem sectio communis arcuum dictorum per* N *punctum, ex conversione definitionis lineæ perpendiculariter super planum erectæ. Quare* C N *est sinus rectus arcus* F C, *&* F N *sinus versus ejusdem.*



His verò in hunc modum expeditis, dico D H *radium esse ad* F M *sinum rectum lateris* A C, *ut* D P *sinus versus anguli ad* A, *ad* F N, *sinum versum arcus* F C. *Item* H A *radium esse ad* A I, *sinum rectum lateris* A B, *ut* F N *sinus versus arcus* F C, *ad* N O *differentiam sinuum versorum tertii lateris, & reliquorum laterum differentiæ. Hoc est, per multiplicationem terminorum, quadratum radii esse ad planum sinuum rectorum* F M *&* A I, *ut* D P *sinus versus anguli ad* A *ab iisdem lateribus comprehensi, ad* N O *differentiam sinuum versorum tertii lateris, & reliquorum laterum differentiæ. Triangula enim* H E P, *&* M C N *sunt æquiangula, ob rectos angulos ad* P *&* N, *æqualem ad* H *&* M, *inclinationis scilicet angulum quadrantis* A C E, *ad quadrantem* A F D. *Itaque per* 4 *Sexti Euclidis, latera habent proportionalia. Quare ut* E H *ad* C M, *ita* P H *ad* N M. *Et quia* D H *ex fabrica æquatur ipsi* D H, *&* F M *ipsi* C M, D H *est ad* F M, *ut* P H *ad* N M: *adeoque per* 5 *Quinti Euclidis, ut* D H *ad* F M, *ita* D P *ad* F N. *Secundò Triangula* F O N *&* F K Q *&* H M Q *sunt æquiangula, ob rectos angulos ad* O *&* K, *communem ad* F. *Item triangula* H M Q *&* H A I *sunt æquiangula, ob rectos angulos ad* M *&* I, *communem ad* H; *itaque per* 4 *Sexti elementorum* H A *est ad* A I, *ut* F N *ad* N O. *Quod erat demonstrandum.*

Ita verò patet veritas primæ partis Theorematis hujus. Etsi enim Triangulum propositum, laterum sit quadrante circuli minorum, valet tamen superior ratiocinatio in Triangulis, quorum latera comprehendentia angulum, vel quadrante circuli majora sunt, vel unum majus, alterum minus. Nam ex 7 *primi hujus, sinus rectus duabus peripheriis communis est, uni, circuli quadrante minori; alteri, quadrante circuli majori. Imo si latera æqualia dentur, non absimilis est argumentandi forma, nisi quod* N O *tunc sit tertii lateris sinus versus.*

Secunda porro pars Theorematatis, quam jure Nobis vendicamus, quod à Nobis primum inventa sit, eodem modo demonstratur quo prima, si prius novum describatur Triangulũ, per polos laterum Trianguli dati. Hujus enim latera angulis, & anguli lateribus primi Trianguli ita respondent, ut in secunda parte Theorematis eadem ferè ratione argumentari liceat, quâ in prima, sicuti ex sequentibus evadet manifestũ.



Sit enim Triangulum A B C *idem quod supra, obtusangulum scilicet ad* B, *acutangulum ad* A *&* C; *& producatur ipsius latus minimum* A B *ex polo* F *in circulum* A K D A: *reliqua vero latera producantur in semicirculos,* A C *quidem ex polo* G *in semicirculum* A C L, B C *autem ex polo* E *in semicirculum* BCD. *Describatur quoque ex polo* A *semicirculus* NFI *transiens per polos* G *&* F; *& ex polo* B *semicirculus* HFK, *transiens per polos* E *&* F; *tandemque ex polo* C *semicirculus* A G L, *transiens per polos* E *&* G; *habebimus tunc novum Triangulum Sphæricum* E F G, *cujus tria latera respondebunt tribus angulis Trianguli* A B C; *& hujus tria latera respondebunt tribus angulis Trianguli* E G F. *Nam quod ad latera Trianguli* E G F *attinet, primum latus* E F *æquale est residuo anguli* A B C *ad semicirculum. Nam* E *est polus semicirculi* B M D, *&* F *est polus semicirculi* B K D, *& proinde* E M *&* FK *sunt circuli quadrantes. Ablato igitur communi medio* F M, *relinquuntur arcus* E F *&* M K *æquales. Atqui* M K *subtendit angulum* M B K *per* 8 *hujus, hoc est residuum anguli* A B C *ad semicirculum. Itaque latus* E F *est æquale residuo anguli* A B C *ad semicirculum.*

Secundo, latus G F *æquatur angulo* B A C. *Nam* F *est polus semicirculi* B K D, *&* G *est polus semicirculi* A C L: *ideoque* G C *&* F I *sunt circuli quadrantes. Remoto igitur communi medio* F C, *remanent arcus* G F *&* C I *æquales. Sed* C I *est mensura anguli* B A C, *per* 8 *hujus. Ergo latus* G F *est æquale angulo* B A C.

Tertio, latus G E *est æquale angulo* A C B. *Nam* G *est polus semicirculi* A C L, *&* E *est polus semi-*

semicirculi B M D : *itaque* E P *&* G L *sunt circuli quadrantes. Dempto igitur communi medio* G P, *reliqui arcus* E G *&* P L *æquantur. Sed* P L *metitur angulum ad* C *per octavum hujus, hoc est angulum* A C B. *Ergo latus* G E *est æquale angulo* A C B.

Atque ita demonstratum est tria latera Trianguli E F G *respondere tribus angulis trianguli* A B C. *Quod autem tres anguli trianguli* E F G, *respondeant tribus lateribus trianguli* A B C *ita ostenditur.*

Primò, angulus E F G *æqualis est lateri* A B. *Nam* A *est polus semicirculi* N F I, *&* B *est polus semicirculi* H F K. *Itaque* B K *&* A I *sunt circuli quadrantes. Quare ablato communi medio* B I, *residui arcus* B K *&* A I *sunt æquales. Atqui* I K *mensurat per* 8 *hujus angulum* I F K, *id est angulum* E F G. *Quare angulus* E F G *est æqualis lateri* A B.

Secundo, angulus F E G *est æqualis lateri* B C. *Nam* B *est polus semicirculi* H F K, *&* C *est polus semicirculi* A G L. *Quare* D M *&* P C *sunt quadrantes circuli; à quibus remoto communi medio* C M, *residui arcus* P M *&* B C *æquantur. At verò* P M *per* 8 *hujus est mensura anguli* P E M, *id est anguli* F E G. *Quamobrem angulus* F E G *est æqualis lateri* B.C.

Tertio, angulus E G F *est æqualis complemento lateris* A C. *Nam* B *est polus semicirculi* H F K, *&* C *est polus semicirculi* A G L. *Itaque* B G *&* C G *sunt circuli quadrantes. Arcus autem* A C, *per* 8 *hujus metitur angulum* A G C, *id est* EGF. *Ergo angulus* E G F *æqualis est complemento lateris* AC. *Nam quia* EF *non metitur angulum* ABC, *sed residuum ad semicirculum* MBK, *idcirco etiam angulus* G *oppositus lateri* E F *non metitur latus* A C, *sed ipsius complementum ad semicirculum* C L.

Apparet autem ex hac demonstratione veritas secundæ partis Theorematis nostri. Nam quia latera & anguli secundi Trianguli E F G *respondent angulis & lateribus Trianguli primi* A B C, *eo modo quo ante demonstravimus, sequitur sane ex eo, eandem esse proportionem laterum & angulorum in triangulo secundo, quæ supra demonstrata est in primo. Sunt ergo termini proportionales in primo Triangulo isti*

Primò, secundum demonstrationem primæ partis Theorematis.

8	6	4	3
D H *radius*	F M *sinus rectus lateris* A C	D P *sinus versus anguli dati*	F N *quartus*
8	4	3	$1\frac{1}{2}$
A H *radius*	A I *sinus rectus lateris* A B	F N *quartus*	N O *differentia sinuum versorum tertii lateris &c.*

Secundò, per multiplicationem terminorum.

64	24	4	$1\frac{1}{2}$
Quadratum radii D H *vel* A H	*Planum sinuum rectorum* F M *&* A I	D P *sinus versus anguli dati.*	N O *differentia sinuum versorũ tertii lateris &c.*

Tertiò, per terminorum transpositionem.

8	6	4	3
A H *radius*	F M *sinus rectus lateris* A C	A I *sinus rectus lateris* A B	F N *quartus*
8	3	4	$1\frac{1}{2}$
D H *radius*	F N *quartus*	D P *sinus versus anguli dati.*	N O *differentia sinuum &c.*

Tot modis licet variare proportionum terminos, in prima Theorematis parte. Verum quia tertius modus & facilior est, & ad usum maxime accommodatus, ideo eum cæteris prætulimus, & in sequentibus porismatibus usurpavimus.

ΠΟΡΙΣΜΑΤΑ *quatuor.*

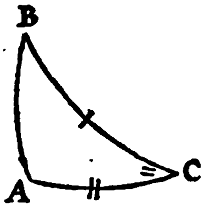
Primum itaque in obliquangulo triangulo, datis duobus lateribus & angulo ab iis comprehenso, investigatur latus tertium. Radius enim est ad sinum rectum lateris unius dati, ut sinus rectus lateris alterius dati ad quartum. Item Radius est ad quartum, ut sinus versus anguli dati ad differentiam sinuum versorum tertii lateris, & reliquorum laterum differentiæ. Hæc igitur differentia ad sinum versum differentiæ laterum adjecta, componit sinum versum lateris quæsiti.

Repetatur penultima nostra diagrapha, & assumatur ut supra Triangulum obliquangulũ Sphæricum ABC, *in quo dentur duo latera* A B *&* A C, *cum angulo ad* A *ab iis comprehenso. Sitque* A B *part.* 50, *& ejus sinus rectus* AI 7660445; AC *partium* 60, *& ejus sinus rectus* F M 8660254: A *angulus ab iis comprehensus part.* 30, *& sinus ejus versus* 1339746, *deniq; sinus versus differentiæ datorum laterum (nempe part.* 10*) sit* 151922. *Propositum est ex his invenire tertium latus* B C, *dato angulo* A *oppositum. Est igitur per præsens porisma,*

ut	A H	*ad* F M,	*ita* A I	*ad* F N
	10000000	8660254	7660445	6634139.
Item ut	D H	*ad* F N,	*ita* D P	*ad* N O *vel* L K.
	10000000	6634139	1339746	888806, *diffe-*

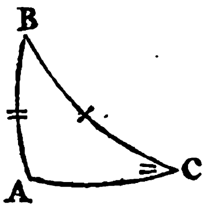
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BASIS



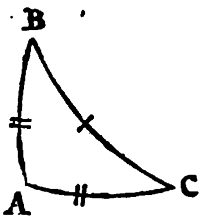
Ex latere & angulo adjacente, *per quintum porisma 13 hujus.*

I	II	III	IIII
ut radius	*ad secant. anguli,*	*ita tang. lateris*	*ad tangent. basis.*
ut radius	*ad sin. compl. ang.*	*ita tang. compl. lat.*	*ad tang. comp. basis.*
ut sec. anguli	*ad radium*	*ita tang. compl. lat.*	*ad tang. comp. basis.*
ut sin. compl. ang.	*ad radium*	*ita tang. lateris*	*ad tangent. basis.*



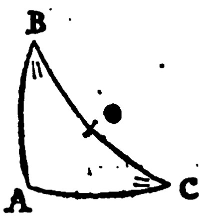
Ex latere & angulo opposito; si constiterit quadrantene major sit, an minor. *per tertium porisma 12 hujus.*

I	II	III	IIII
ut radius	*ad sec. compl. ang.*	*ita sinus lateris*	*ad sinum basis.*
ut radius	*ad sinum anguli,*	*ita sec. compl. lat.*	*ad secant. comp. bas.*
ut sec. compl. ang.	*ad radium*	*ita sec. compl. lat.*	*ad secant. comp. bas.*
ut sinus anguli	*ad radium,*	*ita sinus lateris*	*ad sinum basis*



Ex utroque latere, *per quintum porisma 12 hujus.*

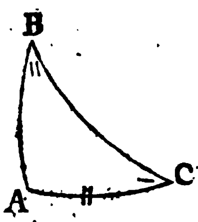
I	II	III	IIII
ut radius	*ad sec. later unius,*	*ita sec. lat. alter.*	*ad sec. basis*
ut radius	*ad sin. cõp. lat. unius.*	*ita sin. cõp. lat. alt.*	*ad sinũ com. bas.*
ut sec. lateris unius,	*ad radium,*	*ita sin. cõp. lat. alt.*	*ad sin. comp. bas.*
ut sin. cõp. lat. unius	*ad radium,*	*ita secans lat. alt.*	*ad secantem basis.*



Ex utroque angulo obliquo, *per octavum porisma 13 hujus.*

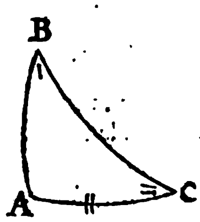
I	II	III	IIII
ut radius	*ad tang. ang. unius,*	*ita tang. ang. alter.*	*ad secantem basis.*
ut radius	*ad tan. cõp. ang. uni.*	*ita tãg. cõp. ang. alt.*	*ad sin. comp. bas.*
ut tang. ang. unius	*ad radium,*	*ita tãg. cõp. ang. alt.*	*ad sin. comp. bas.*
ut tang. cõp. ang. uni.	*ad radium,*	*ita tang. ang. alter.*	*ad secant. basis.*

ANGULUS



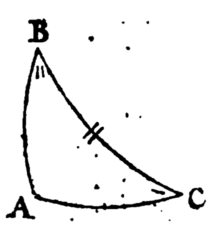
Ex latere & dato angulo opposito, si species quæsiti anguli nota sit; *per 7 porisma 12 hujus.*

I	II	III	IIII
ut radius	*ad secantem lateris*	*ita sin. cõp. ang. dati*	*ad sinum reliqui*
ut radius	*ad sinum compl. lat.*	*ita secans ang. dati*	*ad secant. cõp. reliq.*
ut secans lat.	*ad radium,*	*ita secans ang. dati*	*ad secant. comp. rel.*
ut sinus comp. lat.	*ad radium,*	*ita sin. cõp. ang. dati,*	*ad sinum reliqui.*



Ex latere & dato angulo adjacente, *per sextum porisma 12 hujus.*

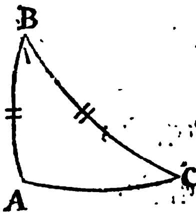
I	II	III	IIII
ut radius	*ad secantem lateris,*	*ita secans comp. ang.*	*ad sec. ang. reliqui*
ut radius	*ad sin. comp. lateris,*	*ita sinus anguli dati,*	*ad sin. cõp. ang. rel.*
ut secans lateris	*ad radium,*	*ita sinus ang. dati*	*ad sin. cõp. ang. rel.*
ut sinus compl. lat.	*ad radium,*	*ita sec. cõp. ang. dati,*	*ad secant. ang. rel.*



Ex basi & angulo dato, *per 7 porisma 13 hujus.*

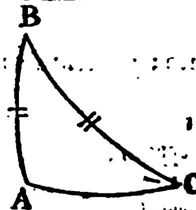
I	II	III	IIII
ut radius	*ad secantem basis,*	*ita tãg. cõp. an. dati,*	*ad tang. ang. reliq.*
ut radius	*ad sin. compl. basis,*	*ita tang. anguli dati*	*ad tang. compl. rel.*
ut secans basis	*ad radium,*	*ita tang. anguli dati*	*ad tang. compl. rel.*
ut sin. comp. bas.	*ad radium,*	*ita tãg. cõp. an. dati*	*ad tang. ang. reliq.*

Ex



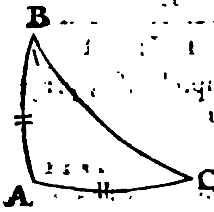
Ex basi & latere adjacente; *per sextum porisma 13 hujus.*

I	II	III	IIII
ut radius	*ad tang. comp. lat.*	*ita tangens basis*	*ad secant. anguli.*
ut radius	*ad tang. lateris*	*ita tang. comp. bas.*	*ad sinum comp. ang.*
ut tang. lateris	*ad radium,*	*ita tang. comp. bas.*	*ad sinum comp. ang.*
ut tang. comp. lat.	*ad radium*	*ita tang. basis*	*ad secant. anguli.*



2 Ex basi & latere opposito; *per secundum porisma 12 hujus.*

I	II	III	IIII
ut radius	*ad secant. comp. bas.*	*ita sinus lateris,*	*ad sinum anguli*
ut radius	*ad sinum basis*	*ita sec. comp. lat.*	*ad sec. comp. ang.*
ut sec. comp. bas.	*ad radium*	*ita sec. comp. lat.*	*ad sec. comp. ang.*
ut sinus basis	*ad radium*	*ita sinus lateris*	*ad sin. anguli.*



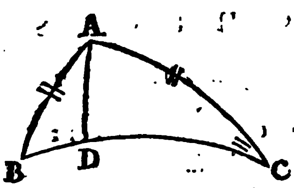
Ex utroque latere; *per tertium porisma 13 hujus.*

I	II	III	IIII
ut radius	*ad sec. cōp. lat. unius,*	*ita tang. lat. alt.*	*ad tang. ang. oppos.*
ut radius	*ad sinum lat. unius,*	*ita tang. cōp. lat. alt.*	*ad tāg. cōp. ang. opp.*
ut sec. comp. lat. uni.	*ad radium,*	*ita tang. cōp. lat. alt.*	*ad tāg. cōp. ang. opp.*
ut sinus lat. unius	*ad radium*	*ita tang. lat. alteri.*	*ad tang. ang. oppos.*

In Obliquangulo Triangulo inveniuntur

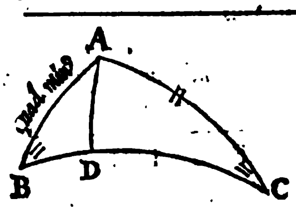
LATUS & ANGULI DUO.

Ex duobus lateribus, & angulo uni eorum opposito; insuper data specie anguli alteri dato lateri oppositi: *per primum porisma 15 hujus.*



Arcus enim perpendicularis demissus ab angulari puncto datorum laterum in tertium latus, continuatum si necesse sit, secat obliquangulum triangulum datum in duo triangula rectangula: ex quorum calculo quæsita dantur.

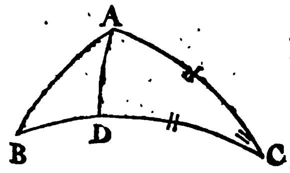
ANGULUS & LATERA DUO.



Ex duobus angulis & latere uni eorum opposito; si constet utrum tertium latus quadrante majus sit, an minus: *per secundum porisma 15 hujus.*

Perpendicularis siquidem arcus à termino lateris dati in latus utrique angulo dato adjacens (continuatum si oportet) descriptus, partitur obliquangulum triangulum datum in duo Triangula rectangula; ex quorum datis postulata innotescunt.

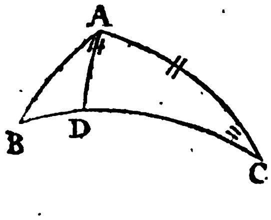
LATUS & ANGULI DUO



Ex duobus lateribus, & angulo ab iis comprehenso; *per tertium porisma 15 hujus.*

Arcus enim perpendicularis, à termino lateris unius dati emissus in alterum latus datum (productum si necesse sit) obliquangulum triangulum in duo triangula rectangula dividit; ex quorum calculo ignota colliguntur.

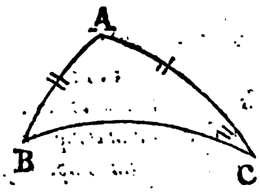
ANGULUS & LATERA DUO



Ex duobus angulis & latere utrique angulo adjacente, *per quartum porisma 15 hujus.*

Nam arcus perpendicularis ab angulo alterutro in oppositum latus (continuatum si necesse sit) egrediens, obliquangulum Triangulum in duo Triangula rectangula secat, ex quorum calculo postulata dantur.

A N-



ANGULUS

Ex duobus lateribus & angulo uni eorum opposito; *per primum porisma 16 hujus. Nam*

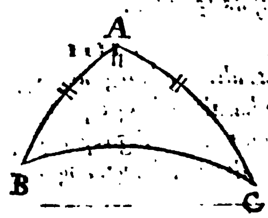
I	II	III	IIII
Vt sinus lateris dati,	*ad sinum anguli oppositi;*	*ita sinus alter. lateris dati,*	*ad sinum ang. oppositi.*



LATUS

Ex duobus angulis, & latere uni eorum opposito; *per secundum porisma 16 hujus. Nam*

I	II	III	IIII
Vt sinus anguli dati,	*ad sinum lateris oppositi,*	*ita sinus alter. ang. dati,*	*ad sinum lateris oppositi.*

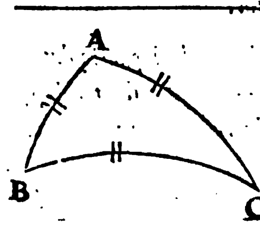


LATUS TERTIUM

Ex duobus lateribus, & angulo ab iisdem comprehenso, *per primum porisma 17 hujus. Nam*

I	II	III	IIII
Vt radius.	*ad sinum rectum lateris unius*	*ita sinus rectus lateris alterius*	*ad quartum.*
Vt radius,	*ad quartum*	*ita sinus versus anguli dati*	*ad differentiam sinuum versorum tertii lateris, & reliquorum laterum differentiæ.*

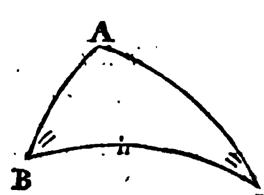
Hæc vero differentia ad sinum versum differentiæ laterum adjecta, componit sinum versum lateris quæsiti.



ANGULUS QUIVIS

Ex tribus lateribus; *per secundum porisma 12 hujus. Nam*

I	II	III	IIII
Vt radius	*ad sinum rectum lat. unius,*	*ita sinus rectus later. alterius*	*ad quartum.*
Vt quartus	*ad radium,*	*ita differentia sinuum vers. tertii lat. & reliq. laterum differentiæ.*	*ad sinum versum ang. quæsiti.*

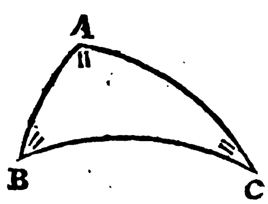


ANGULUS TERTIUS.

Ex duobus angulis, & latere utrique angulo adjacente; *per tertium porisma 17 hujus. Nam*

I	II	III	IIII
Vt radius	*ad sin. rectum ang. unius,*	*ita sin. rectus ang. alterius*	*ad quartum*
Vt radius	*ad quartum*	*ita sinus versus lateris dati*	*ad differentiam sinuum versorum quæsiti anguli, & differentiæ anguli unius dati, & alterius ad semicirculum residui.*

Differentia igitur hæc addita ad sinum versum anguli unius dati, & reliqui ad semicirculum complementi, componit sinum versum anguli quæsiti.



LATUS QUODVIS.

Ex tribus angulis; *per quartum porisma 17 hujus. Nam*

I	II	III	IIII
Vt radius	*ad sinũ rectũ ang. unius,*	*ita sinus rectus ang. alter.*	*ad quartum*
Vt quartus	*ad radiũ,*	*ita differentia sinuum vers. tertii angul. & differentiæ ang. unius, & alter. ad semicirculũ residui.*	*ad sinũ versum lateris quæsiti.*

Μόνῳ τῷ Θεῷ δόξα.

PHILIPPI LANSBERGII

CYCLOMETRIÆ NOVÆ

LIBRI DUO.

Illustrissimo Principi ac Domino D. *Mauricio* Principi Auraico, Comiti Nassovio, &c. Gubernatori Belgii confœderati, & Ἀρχιστρατηγῷ, &c.

ET

Illustribus ac Potentibus Zelandiæ Ordd. Dominis ac Mecœnatibus suis sibi plurimùm venerandis.

CIRCULI geodæsia, quam magnus Archimedes κύκλου μέτρησιν appellat, propter utilitatem quã societati hominum atque communitati adfert insignem, jam multis ab hinc seculis ubivis gentium exculta est. Et primùm ante annos bis mille & sexingentos in Palæstina, sub magni Solomonis imperio. Tunc enim inter cætera templi ornamenta intestina, constructum fuit mare æneum circumquaq; rotundum, factaque ipsius dimensione, deprehensum, quod decem cubiti essent à labii parte unâ ad alteram, & quod filum triginta cubitorum idem cingeret circumquaque. Erat itaque tum temporis Cyclometria quædam in usu, rudis scz. illa, quæ diametri & peripheriæ rationem ponebat triplam, hoc est, ut X ad XXX.

At septingentis annis post Solomonem, circa Platonis tempora, accuratior quædam circuli dimensio in Græcia caput efferre cœpit, quando magni Viri Bryso, Antipho, Hippocrates Chius, Cyclometrica sua inventa dabant in publicum, laudemq; Cyclometriæ inventæ singuli affectabant. Brysonem enim excipiebat Antipho; Antiphontem Hippocrates, atque hunc deinceps alii, manente tamen Cyclometriæ laude penes Hippocratem. Nam ut testis est Aristoteles, Brysonis τετραγωνισμὸς erat ἐριστικὸς, ψευδογράφος; Antiphontis reprehensione Geometrica indignus. Hippocratis contra qui fiebat per μηνίσκους verè erat Geometricus: quo tamen posteritas minimè fuit contenta, quod non tam circuli esset, quàm duorum circuli μηνίσκων.

 Hos

Hos omnes, qui εὐτυχεῖς erant, ducentorum proximè annorum intervallo sequutus est Archimedes Syracusanus, vir miræ sagacitatis, qui τετραγωνισμὸν Antiphontis mutuatus duo demonstravit; unum, cujuslibet circuli circumferentiam suæ diametri esse triplam, & adhuc excedere minori quidem parte quam septimâ diametri, majori autem quam decem septuagesimis primis. Alterum, Omnem circulum æqualem esse triangulo rectangulo, cujus unum latus circa rectum æquatur radio circuli, alterum perimetro. Quæ elementa etsi posteritas agnoverit γεωμετρικῶς ab Archimede esse demonstrata, non acquievit tamen in ipsius Cyclometria, quam tertio elemento proposuit, quòd à veritate non nihil distaret. Testes sunt Apollonius Pergæus magnus Geometra, Ptolemæus Alexandrinus Astronomiæ Princeps, Philo Gadarenus, atque alii quorum Eutocius Ascalonita meminit, qui omnes summâ ope ac studio conati sunt Cyclometricum negotium ἐπὶ τὸ σύνεγγυς μᾶλλον ἀγάγειν. In quam quoque cogitationem & curam incubuerunt Dinostratus, Nicomedes, & quotquot deinceps Mathematici præstantes sequuti sunt ad nostra usque tempora.

Porro cùm nobis valdè doleret, nobilissimam Geometriæ partem, in qua tot seculis totque à Geometris sudatum esset, in splendorem suum non modò nondum esse redditam, sed ψευδοτετραγωνισμοῖς multorum magis fœdatam, ingensq; restituendi eam cupiditas animum nostrum incesseret; admovimus & nos, σὺν τῷ θεῷ, operi manum, observataq; circuli naturâ, ac signis quæ illi insunt, tandem post aliquot annorum vigilias, & pertinacem cogitandi assiduitatem, Cyclometriam de integro exstruximus, novam quidem, sed quæ cum vetere de palmâ certare audeat. Hanc Flacci consilio nonum pressimus in annum: verùm quia ultra jam premi negat, bono rei literariæ manumittimus. Stat enim in carceribus ἄστρου ὥσπερ τῆς ἑσπέρας ἕτοιμος ἐς ἅμιλλαν.

Ut autem in manus hominum veniret gratior, volui eam Illustrissimæ T. C. ac DD. V. Illustribus & Potentibus inscribere, Archimedem sequutus, qui partem operum suorum optimam dicavit suo Dositheo. Etsi enim Mathemata per se Mathematicis Viris sint accepta, tamen quia persæpè incidunt in manus ἀγεωμετρήτων, utile est laudatorum Virorum nominibus esse insignita, ut qui ab illis abhorrent maximè; eorum saltem exemplo ad ea invitentur.

In primis decet ut qui Mathematica tractant publicè, bonorum ac sapientum Principum mentionem faciant. Nam quia boni & sapientes Principes hæc studia præcipuè juvant, consentaneum est ut

ut ii quibus opem ferunt, vicissim virtutem ac liberalitatem eorum agnoscant, quantumque fieri potest, grato animo prædicent. Quamobrem cùm & vos esse Mathematicarum artium fautores constet, & te, Princeps Illustrissime, inter Mathematicos nostri seculi primum; æquum esse putavi ut & ego sapientiæ ac virtutum Vestrarum ornamenta publico testimonio cõprobarem: præsertim cum totos triginta annos benevolentiæ Vestræ aurâ fuerim afflatus, jamque in hoc meo senio, summo Vestro favore ac magnificentiâ, ocio fruar literario. Agnosco enim & me hoc nomine Vobis debere plurimum, & illos quoque qui deinceps ocii nostri fructum percipient.

Oro itaque te Illustrissime Princeps, Vosque Ordd. Illustres & Potentes, quàm possum reverenter, Cyclometriam ut hanc nostram, in speciem quidem exiguam, sed materia & labore maximam, patiamini sub Illustrissimis V. Nominibus venire in lucem; eamque extare ut publicum observantiæ ac gratitudinis meæ erga Vos monumentum. Hoc enim animo eandem Vobis do, dico, consecro, cupioque ut quæ laus inde expectanda est, Vobis cedat; Quibus jam pridem me totum devovi; Quibusque jam studia mea sub misse commendo. Vale Illustrissime Princeps, & Vos Ordd. Illustres ac Potentes. Middelburgi Zelandiæ, pridie Idus Januar. CIↃ IↃ C XVI.

Illustriss^a T. Celsitudini, ac D D. V. Illustribus & Potentibus

Addictissimus

P. LANSBERGIUS.

Ex literis Clarissimi, Doctissimique viri Willebrordi Snellii, R. F. ad Philippum Lansbergium.

TUAM verò novam quadraturam non leviter admiror, qui etiam in vastissimis illis numeris tam prope verum collimaris; unde facilè conjecturam capio, eam vero assidere. Quod tamen Cl. Ludolphum in ratione diametri & peripheriæ constituenda hallucinatum censes, haud possum tecum sentire: neque enim est ratio legittima quam ponis 20000000000000000000000 ad 62831853071795864769128. Sed ista 20000000000000000000000000 ad 62831853071795864769252867 & amplius. Habes numeros tuis majores. Cæterum verissimè illud notasti omnes Veterum quadraturas in numeris maximè expediri. Nam volutas Sisyphus aliquis per puncta & pinnas rotabit, volvetque. Apage mihi istas, quia à χειρεργία sunt alienissimæ. Quare quod ais ex tuo invento rectam circulo quadrando proximè æqualem ita describi, ut facilitas cum certitudine contendat, eo ipso sine dubio mirificè hominum studia excitabis. Imò quis tibi non plaudet, cùm videbit unum aliquem hac ætate inventum, qui non desperarit secula proficere semper? qui non dubitarit cum summis Mathematicis de prima summâque Mathesios laude decertare. Archimedem redivivum, quadratorem novum te amplectetur hæc ætas, agnoscent posteri, qui primus post Veteres novo epichiremate id opus tentaris & perfeceris; & propterea grato animo tuam memoriam recolent, cum tanto & tam amplo patrimonio mathematicam rempublicam à te auctam & locupletatam cogitabunt. Imò nos beabis, cum quadratores novos, qui è nido evolant crocitatores odiosi & molesti, nobis amplius molestos esse non sines. Est enim quoddam hominum genus insolita temeritate, & impudenti audacia, qui simul ac oculos Barbarico cœno infossos pauxillum mathematico sole clariores habent, statim in circuli quadraturam tanquam materiam suis viribus aptam involant, atque ea quæ ex antiquo ignorantiæ cœno hausere, nobis tanquam maximè ratas sententias obtrudere conantur. Hinc tanta ψευδοτετραγωνισμῶν, omnibus ævis copia, neque enim hoc hominum genus demum χθὲς καὶ πρώην εἰς τοὺς ἀνθρώπους κατεφθάρη, vetus hoc malum est, & Veteribus quoque adgnitum. Atque ideo tanto impensiùs te rogo Clarissime LANSBERGI, ne ista diutius premas, neve anteactas tuas vigilias sinas interire, quod futurum fuisse scribis, nisi aliquando à nobis excitatus, & in antiquam palæstram penè reductus esses. Neque enim decet te Aspendium citharistam imitari, quem omnia intus canere dicebant, ut tu quoque tibi soli sapias; sed multo magis ut publicè prosis, & Belgici nominis claritatem nunc ad exteros, olim verò ad posteros propages. Vale Vir Clarissime, & affectum quo nos hactenus complexus es deinceps porro continuato. Lugduni Batavorum XI. Octobr. CIↃ IↃ CVII.

Tuus, tibique addictissimus

WILLEBRORD. SNELLIUS, R. F.

Lectori benevolo S.

HAbes, Lector benevole, Cyclometrica nostra, jamdiu à nobis efflagitata; quæ si grata tibi esse cognovero, dabo operam ut Astronomica nostra, saltem pars eorum prima de motu diurno, annuo, menstruo, mox ad te perveniat. Vale bone Lector, & studiis nostris fave.

CYCLO-

CYCLOMETRIÆ

LIBER I.

De dimensione circuli ambitus.

1. *Cyclometria est pars Geometriæ quæ circulum benè metiri docet.*

QUOD magnus Archimedes κύκλου μέτρησιν appellat, nos una voce Cyclometriam dicimus. Pars est Geometriæ nobilissima in qua se exercuerunt præstantissimi Geometræ, prisco quidem seculo, *Bryso*, *Antipho*, *Hippocrates Chius*, *Dinostratus*, *Euclides*, *Archimedes Syracusanus*, *Appollonius Pergæus*, *Ptolemæus*, *Nicomedes*, *Pappus Alexandrinus*, *Sporus Nicenus*, *Philo Gadarenus*, *Eutocius Ascalonita*, *Boëtius*, *Çampanus*, & alii: nostro verò & Proavorum ævo; *Nicolaus Cusanus Cardinalis*, *Ioannes Regiomontanus*, *Orontius Delphinaus*, *Iacobus Peletarius*, multique post illos, quorum nomina referre non est opus. Cæterum etsi inter omnes quos dixi magnus Archimedes Cyclometricum negotium maximè promoverit, haud satis tamen elaboratam fuisse ipsius Cyclometriam, quotquot eum celebres Geometræ sequuti sunt, ad unum omnes judicarunt. Hinc factum est, quod qui post ipsius tempora ingenio & Mathesios scientia insignes fuerunt, vires omnes intenderint, ut Cyclometriam Archimedæa ἀκριβέστερον darent. Ego verò etsi minimus sim omnium quos dixi, audeo tamen in Cyclometricam arenam descendere, & polliceri, Cyclometriam quam nunc profero in lucem, Veritati & Geometriæ principiis magis esse consentaneam, quàm, Geometrarum qui nos præcesserunt. Quod tamen non arroganter, sed pro rei veritate ingenuè dictum esse, in sequentibus, Deo volente, satis superque evincam.

2. *In circulo ad benè metiendum duo proponuntur, circuli ambitus, & area.*

Tria in circulo considerantur, centrum, peripheria, superficies, vel area. Centrum verò quia puncti locum obtinet, magnitudinis est expers. Peripheria verò & superficies, quia magnitudines sunt, sub mensuram cadunt; utraque igitur in circulo ad benè metiendum proponitur.

PORISMA.

Itaque Cyclometria duabus partibus absolvitur, ambitus circuli dimensione & area.

Porismatis consequentia manifesta est. Quia enim in circulo duo tantùm ad benè metiendum proponuntur, ambitus circuli & area, necesse est Cyclometriam duabus tantùm partibus absolvi, Dimensione ambitus circuli & areæ. Quare de istis sigillatim agendum est.

3. *Ambitum circuli dimetiri, est non modò rectam describere cujusvis circuli propositi peripheriæ æqualem, & cuicunque rectæ datæ æqualem circuli peripheriam; sed rationem quoque explicare quam inter se habent peripheria cujusvis circuli dati & diameter.*

Ambitus circuli dimensio vel Geometricè instituitur, vel Arithmeticè. Si Geometricè, oportet rectam lineam describere circuli propositi peripheriæ æqualem, vel rectæ datæ æqualem circuli peripheriam. Sin Arithmeticè, definienda est ratio, quam inter se habent peripheria data & diameter. Archimedes utrumque facere conatus est. Nam 18. περὶ ἑλίκων rectam lineam ducere instituit circuli dati peripheriæ æqualem. Secunda verò propositione περὶ κύκλου μετρήσεως, cujuslibet circuli peripheriæ rationem ad diametrum definire tentat. Quare & nobis utrumque est præstandum.

4. *Si peripheriæ sinus aut tangens, ad dimidiæ peripheriæ sinum aut tangentem fuerit, ut peripheria ad peripheriam dimidiam, peripheria, sinus, tangens, inter se æquales erunt.*

Sinus & tangentes peripheriis æquales voco, non qui absolutè æquales sunt, sed qui æqualitatem habent, saltem in dato circulo, vel circulis dato circulo minoribus. Absolutè enim nullus sinus aut tangens peripheriæ suæ est æqualis. Nam quia omnis inscripta minor est sua peripheria, & circumscripta omnis major, oportet etiam semisses inscriptarum, id est sinus peripheriis suis esse minores; & circumscriptarum semisses, hoc est tangentes iisdem majores. Hipotheticè verò sinus & tangens arcui suo æqualis est, quando eorum discrimen nullum ostendi potest in dato circulo. Nam ut acutissimus Geometrarum nostri seculi *Nicolaus Copernicus* annotavit lib. Revolut. 1. cap. 12. problemate ultimo, inscriptæ, adeoque & sinus & tangentes, per continuam bisectionem peripheriarum tendunt ad æqualitatem, tandemq; ad extremum circuli contactum æquales fiunt acsi una linea essent.

Dico igitur peripheriam, sinum, tangentem esse inter se æquales, si peripheriæ sinus vel tangens sit ad sinum vel tangentem peripheriæ dimidiæ, ut peripheria ad peripheriam dimidiam. Nam si inæquales essent, etiam per demonstrata Ptolemæi libro μεγάλ. συντάξ. 1. cap. 9. essent disproportionales. Atqui ex hypothesi proportionales sunt, ergo etiam inæquales. Nam proportionem hîc semper sequitur æqualitas, & inæqualitas disproportionem. Illustre, exemplum subministrat Canon Sinuum & Tangentium in peripheriis grad. 0. 10, & grad. 0. '5. Illius enim & sinum & tangentem eundem exhibet particul. 29088, hujus verò particul. 14544, in mensura radii 10000000.

Sunt autem hi sinus & tangentes peripheriis suis primum proportionales. Nam peripheria grad. 0 10, se habet ad peripheriam grad. 0. '5, ut sinus vel tangens 29088, ad sinum, vel tangentem 14544.

Secundò iidem sinus tangentibus suis æquales sunt. Nam peripheriæ grad. 0. 1 6, idem est sinus & tangens particul. 29088; idemque est sinus & tangens peripheriæ grad. 0. '5. particul. 14544.

Tertiò ii ipsi Sinus & Tangentes peripheriis suis æquales sunt. Quia enim sinus tangentibus suis æquales sunt, oportet etiam peripheriis suis æquales esse, quæ tangentibus absolutè sunt minores. Item quia tangentes sinibus æquales sunt, necesse est peripheriis suis quoque æquales esse, quæ sinibus suis absolutè sunt majores. Itaque peripheria, sinus, tangens, inter se æquales sunt, cum peripheriç sinus vel tangens est ad sinum vel tangentem, peripheriæ dimidiæ, ut peripheria ad peripheriam dimidiam. Quod erat demonstrandum.

5. *Si dati circuli quadrans per bisectionem in quotvis partes æquales dividatur, radiusque erectus in partes æquales totidem; & à puncto divisionis radii ultimo, per divisionis quadrantis punctum ultimum recta ducatur in ultimi arcus tangentem; abscindet hæc ex dicta tangente tangentem arcui quadrantis ultimo æqualem.*

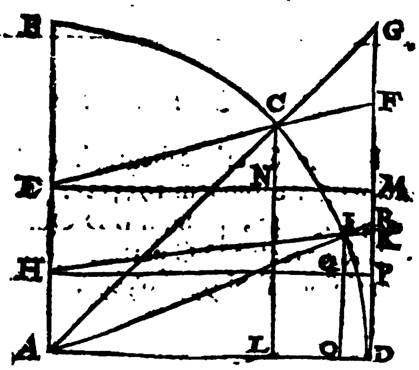
Hoc Theorema totius Cyclometriæ fundamentum continet. Quare perspicuè explicari, accuratéque demonstrari debet.

Datum itaque circulum appello, cujus radius in certa mensura datus est, puta 10, 100, 1000, 10000, 100000, 1000000, 10000000, vel quæcunque alia.

Ultimum arcum Quadrantis dico, qui peripheria Quadrantis, vel semel, vel quoties libet, bisectæ, est ultimus.

Denique rectam ultimo Quadrantis arcui æqualem dico, non quæ talis est in omni circulo, sed saltem in dato.

Esto jam in adjuncto schemate Quadrans circuli A B C D, cujus peripheria B C D & radius erectus A B bisecentur, ille in C, hic in E; ducaturque ab E bisectionis radii puncto, per C bisectionis Quadrantis punctum recta E C F in D G tangentem ultimi arcus D C. Dico E C F secantem abscindere ex tangente D G, tangentem D F, æqualem ultimo quadrantis arcui D C.



Demonstratio perspicua erit si semiradius A E bisecetur in H, & D C semiquadrans in I, & ex puncto H per punctum I ducatur recta H I K in tangentem D G. Hæc enim quia tangentem D F abscissam bisecabit in K, erit D F ad D K, ut peripheria D C ad peripheriam dimidiam D I, adeoque per præmissum elementum, D F tangens abscissa, æqualis erit ultimo arcui D C, & illius semissis D K hujus semissi D I. Quorum veritas cum in numeris sit maximè conspicua, subiicio sequentem calculum.

Sit A B radius particul. 10, vel 100 (libet enim metiri circulum, omnium qui dari possunt minimum) eritque A E semiradius particul. 50, & C D semiquadrans grad. 45, quorum B C D totus quadrans est 90. Demittatur quoque perpendicularis C L ex C termino arcus D C in radium A D; erit hæc sinus rectus arcus D C particul. 70, qualium A D radius est 100, & A L vel E N sinus complementi itidem particul. 70. Præterea ex E in tangentem D F ducatur recta E M parallela A D, quæ C L secet in N; tandemque

auferatur ex C L	70.
L N id est A E	50.
eritque residua N C	20.

Quoniam verò triangula E M F & E N C sunt similia, propter rectos angulos ad M & N, communem ad E, per 4m Sext. Euclidis est,

Ut E N 70, ad N C 20, ita E M id est A D 100 ad M F	$28\frac{6}{10}$ proxime. cui
si addas D M	50
Componitur D F	$78\frac{6}{10}$

D F itaque est particul. $78\frac{6}{10}$ qualium A B radius est 100.

Definienda deinceps est quantitas D K in eadem mensura radii. Quia igitur A E est particul. 50, semissis ejus A H est particul. 25. Item quoniam arcus C D est grad. 45, ejus dimidius D I est grad. $22\frac{1}{2}$, ejusque sinus rectus I O particul. $38\frac{2}{10}$ in mensura radii 100, & complementi sinus A O id est H Q $92\frac{3}{10}$

Subducatur verò & hic ex I O	$38\frac{2}{10}$
Q O id est A H	25
reliqua erit Q I	$13\frac{2}{10}$

Itaque per 4 Sexti Euclidis ut supra

Ut H Q $93\frac{3}{10}$ ad Q I $13\frac{2}{10}$, ita H P 100 ad P K	$14\frac{3}{10}$. Cui si
addas D P	25
Componitur D K	$39\frac{3}{10}$

Hinc autem manifestum est rectam H I K bisecare D F in K; Est enim

Ut D F $78\frac{6}{10}$ ad D K $39\frac{3}{10}$, ita D C arcus grad. 45 ad D I arcus grad. $22\frac{1}{2}$. Quare per præcedens elementum recta D F æqualis est arcui D C, & recta D K arcui D I, in qua-

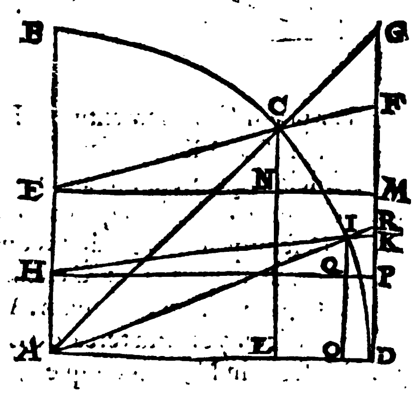
drante

drante A B D, cujus radius datus est particul. solummodo 100. Quod erat demonstrandum.

Et hæc quidem est Theorematis nostri demonstratio, adeo firma, ut nulla ejus particula cum ratione possit convelli. Ut tamen ipsius veritas manifestior reddatur, subiicio plura exempla, ex quibus apparebit, quod in uno ostensum fuit, verum esse in omnibus.

Secundum exemplum ex magno Canone Rhetici.

Retenta superiore diagrapha; esto radius A B particul. 1000000000, & A E pars ejus ultima $\frac{1}{512}$; earundem 1953125. Sit etiam arcus D C $\frac{1}{512}$ pars Quadrantis B C D, grad. 0. 10. 32. 48. 45, qualium B D Quadrans est 90. Detur quoque ex magno Canone Rhetici C L sinus rectus D C particul. 3067956, quarum radius A B est 1000000000, & complementi sinus E N 999995293.



Ablato primum ex C L	3067956
Ultima parte radii L N	1953125
relinquitur N C	1114831

Unde per 4 Sexti Euclidis

Ut E N 999995293 ad N C	1114831,
ita E M 1000000000 ad M F	1114836.
cui si addas ult. part. rad. D M	1953125
Erit D F	3067961

Bisera jam A E 1953125, & arcum D C grad. 0. 10. 32. 48. 45, erit A H $976562\frac{1}{2}$ & D I grad. 0 5 16 24 $22\frac{1}{2}$, ejusque rectus sinus I O 1533980, & complementi H Q 999998823.

Porro & hic ex I O	1533980
subducatur A H	$976562\frac{1}{2}$
reliqua erit Q I	$557417\frac{1}{2}$

Quamobrem per 4^m Sexti Euclidis

Ut H Q 999998823 ad Q I	$557417\frac{1}{2}$
ita H P 1000000000, ad P K	557418. Cui
si addas D P	$976562\frac{1}{2}$
Erit D K	$1533980\frac{1}{2}$.

Unde iterum manifestum est rectam H I K bisecare D F in K; est enim

Ut D F 3067961 ad D K $1533980\frac{1}{2}$ ita arcus D C ad arcum D L

Quamobrem per præcedens elementum, D F est æqualis D C, & D K est æqualis D I. Quod erat ostendendum.

Cæterum ne quis existimet rem aliter se habere in radiis majoribus, addam unum atque alterum exemplum radiorum majorum. Utque ἐπιλογισμὸς expeditior sit, tum in sequentibus exemplis, tum in reliquis omnibus, præmitto tres Canones, quorum magnus est usus in Cyclometrico calculo.

Primus Canon continet continuas διχοτομίας radii vastissimi, viz. particularum.

100000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 0.

Exhibet autem hic Canon in ima parte, radii particulas; in sinistro margine bisectionis numerum, hoc est, quoties radius bisectus sit; in area communi, particulas ultimæ partis radii.

Canon

Canon continuæ [illegible] radii qui ponitur particularum.

100000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 0.

1	5
2	25
3	125
4	625
5	3125
6	1562, 5
7	781, 25
8	390, 625
9	195, 3125
10	97, 65625
11	48, 82812, 5
12	24, 41406, 25
13	12, 20703, 125
14	6, 10351, 5625
15	3, 05175, 78125
16	1, 52587, 89062, 5
17	76293, 94531, 25
18	38146, 97265, 625
19	19073, 48632, 8125
20	9536, 74316, 40625
21	4768, 37158, 20312, 5
22	2384, 18579, 10156, 25
23	1192, 09289, 55078, 125
24	596, 04644, 77539, 0625
25	298, 02322, 38769, 53125
26	149, 01161, 19384, 76562, 5
27	74, 50580, 59692, 38281, 25
28	37, 25290, 29846, 19140, 625
29	18, 62645, 24923, 09570, 3125
30	9, 31322, 57461, 54785, 15625
31	4, 65661, 28730, 77392, 57812, 5
32	2, 32830, 64365, 38696, 28906, 25
33	1, 16415, 32182, 69348, 14453, 125
34	58207, 66091, 34674, 07226, 5625
35	29103, 83045, 67337, 03613, 28125
36	14551, 91522, 83668, 51806, 64062, 5
37	7275, 95761, 41834, 25903, 32031, 25
38	3637, 97880, 70917, 12951, 66915, 625
39	1818, 98940, 35458, 56475, 83007, 8125
40	909, 49470, 17729, 28237, 91503, 90625
41	454, 74735, 08864, 64118, 95751, 95312, 5
42	227, 37367, 54432, 32059, 47875, 97656, 25
43	113, 68683, 77216, 16029, 73937, 98828, 125
44	56, 84341, 88608, 08014, 86968, 99414, 0625
45	28, 42170, 94304, 04007, 43484, 49707, 03125
46	14, 21085, 47152, 02003, 71742, 24853, 515625

1 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 0.

In exemplo, si detur radius particul. 100000, 00000, 00000, 00000, 00000, 000, ultima pars radii est 37252, 90298, 46191, 40625. numerentur enim in ima parte Canonis circuli 28, & à postremo circulo ascendatur directè ad numerum ultimum, erit hic numerus ultimus numerus postremæ partis radii, viz. 37252, 90298, 46191, 40625. Numerus autem 28 in sinistro margine, ultimæ parti radii respondens, indicat quoties radius datus bisectus sit, nimirùm vicesies & octies.

Item si detur radius partic. 100000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 0, ultima pars radii est, 14210, 85471, 52020, 03717, 42248, 53515, 625. Nam si & hic in ima parte Canonis, circuli 46 numerentur ab unitate radii, & ab ultimo circulo sursum ascendatur directè ad ultimum numerum, erit hic numerus ultimæ partis radii, numerusque 46 in sinistro Canonis margine, docet quoties radius sit bisectus, viz. quadragesies & sexies. Et hic quidem est primus Canon; sequitur alter.

Canon continuæ bisectionis peripheriæ Quadrantis.

1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256
9	512
10	1024
11	2048
12	4096
13	8192
14	16384
15	32768
16	65536
17	131072
18	262144
19	524288
20	1048576
21	2097152
22	4194304
23	8388608
24	16777216
25	33554432
26	67108864
27	134217728
28	268435456
29	536870912
30	1073741824
31	2147483648
32	4294967296
33	8589934592
34	17179869184
35	34359738368

Hic Canon exhibet continuam bisectionem peripheriæ Quadrantis, à prima bisectione usque ad quadragesimam sextam. Licet autem ex hoc Canone, vel uno intuitu cognoscere quota pars Quadrantis sit ultimus arcus ex continua bisectione factus. Numerus enim in sinistro margine ostendit quoties datus quadrans sit bisectus: at qui in area se offert, docet quota pars Quadrantis sit arcus à bisectione ultima factus.

In exemplo detur peripheriæ Quadrans, cujus radius sit particul. 100000, 00000, 00000, 00000, 00000, 000; Ex superiori Canone constat (uti etiam ex numero circulorum radii) ultimam partem radii fieri ex bisectione ipsius radii, vicesies & octies continuata. Atqui & ultimus Quadrantis dati arcus fit ex bisectione Quadrantis toties continuata. Quare ut numerus 28 in præmisso Canone præbet partem ultimam radii; ita in præsenti Canone ultimum arcum Quadrantis nimirum $\frac{1}{268435456}$. Qualium itaque peripheriæ datus Quadrans particularum est 268435456, Ultimus quadrantis arcus est una particula.

Eodem modo ultimus arcus peripheriæ Quadrantis, cujus Radius ponitur particularum 100000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 000000, ex præsenti Canone obtinetur $\frac{1}{70368744177664}$. Superior enim Canon (uti & numerus circulorum radii) docet bisectionem Radii quadragesies & sexies esse continuandam. At ut numerus 46 in præmisso Canone dat ultimam partem Radii; ita in præsenti Canone dat ultimum arcum Quadrantis, viz. $\frac{1}{70368744177664}$. Qualium itaque Quadrans circuli datus est particularum 70368744177664, arcus quadrantis ultimus est particula una.

Tertius Canon continet subtensas complementorum arcuum ad semicirculum, qui ex continua bisectione Quadrantis oriuntur, idque in mensura Radii vastissimi particul. 100000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 0. Quem Canonem summa industria, atque indefesso labore supputavit logistarum nostri seculi Princeps *Ludolphus à Collen*, eundemq; abhinc octennium nobiscum perhumaniter communicavit. Licet autem ex subtensis istis citra calculi molestiam supputare peripheriarum sinus, quæ ex continua

Qua-

Reliquum præcedentis Canonis.

36	68719476736
37	137438953472
38	274877906944
39	549755813888
40	1099511627776
41	2199023255552
42	4398046511104
43	8796093022208
44	17592186044416
45	35184372088832
46	70368744177664

Quadrantis bisectione proveniunt, in mensura radii 100000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 0000. saltem ad bisectionem Quadrantis $46^{m.}$ Tot enim subtensas Canon exhibet; neque plures desiderantur, respectu Canonum præmissorum, qui quadragesimam sextam Radii & Quadrantis bisectionem non transcendunt.

Ratio autem subtensarum hæc est. Prima subtensa est peripheriæ Quadrantis. Secunda differentiæ $\frac{1}{2}$ peripheriæ Quadrantis & semicirculi. Tertia differentiæ $\frac{1}{4}$ peripheriæ Quadrantis & semicirculi, atque ita deinceps usque ad quadragesimam sextam, quæ est subtensa differentiæ $\frac{1}{70368744177664}$ peripheriæ Quadrantis & semicirculi.

Primæ autem subtensæ & Diametri differentiæ latus quadratum est subtensa $\frac{1}{2}$ peripheriæ Quadrantis; itaque semissis ejus est sinus $\frac{1}{4}$ Quadrantis. Secundæ subtensæ & diametri differentiæ latus quadratum est subtensa $\frac{1}{4}$ peripheriæ Quadrantis, & semissis ejus est sinus $\frac{1}{8}$ Quadrantis. Tertiæ subtensæ & Diametri differentiæ latus quadratum est subtensa $\frac{1}{8}$ peripheriæ Quadrantis, & semissis ejus est sinus $\frac{1}{16}$ Quadrantis, atque ita deinceps. Unde manifestum est quomodo ex Canone subtensarum cujusvis arcus ultimi & complementi sui sinus investigandi sint. Primùm ex numero circulorum Radii dati, vel ex præmissis Canonibus colligendum est, quota quadrantis bisectio det ultimum quadrantis dati arcum. Deinde cum numero quoto ingredi oportet Subtensarum Canonem, & subtensam sumere quæ quoto numero respondet. Hujus semissis est sinus complementi arcus ultimi dati. Latus verò quadratum differentiæ subtensæ immediatè præcedentis & Diametri, est sinus rectus ipsius arcus ultimi. Ecce autem Canonem ipsum.

Canon subtensarum arcuum peripheriæ Quadrantis continuè bisectæ.

PARTICULÆ DIAMETRI.

20000000000000000000000000000000000000000000000000000000

1	14142135623730950488016887242096980785696718753769480 7
2	18477590650225735122563663787935765736448332517272849 7
3	19615705608064608982523644722684780739478674617866721 9
4	19903694533443937724896739062189598431509497374597141 2
5	19975909124103447854295432095182013888864072294092237 3
6	19993976373924084402315312993323443937001221625154592 8
7	19998494036782890818432529823927664487012129376044356 6
8	19999623505652022853139808754571354323478345018886701 8
9	19999905876191523430231602514002397991059752672443753 08
10	19999976469034038198580514203430520380965358457795300 78
11	19999994117257644383204564354775313542325277986986032 03
12	19999998529314357022894629614147757138964023113778455 32
13	19909999963232858587616693830805819429010152102485560 705
14	19999999990808214625781943866279212297917788606378905 647
15	19999999997702053655125346615589108216801074832388564 246
16	19999999999425513413698827944437283552178178915836570 505
17	19999999999856378353419550191767700980520960666219031 603
18	19999999999964094588354565248295568214759278374992551 601
19	19999999999991023647088621768345994648883029202930628 122
20	19999999999997755911772154033103505073007698443821045 219

Reliquum præcedentis Canonis.

21	199999999999943897794303842958943916890403601900060424
22	1999999999999859744485759602479457473516421086293467729
23	1999999999999964936121439900312495473459750637897030419
24	1999999999999991234030359475058913312432477910669911536
25	1999999999999997808507589993763527668362340742051587894
26	1999999999999999452126897498440806875856474014516347312
27	1999999999999999863031724374610197028886986555441481278
28	19999999999999999965757931093652548964091925892098639953
29	19999999999999999914394827734131372227023676352051762
30	1999999999999999997859870693352843045105535567959749 25
31	1999999999999999999464676733383210760610734915557413 55
32	1999999999999999999866241918334580269010795566786232066
33	199999999999999999999665604795836450672524193413151390 62
34	1999999999999999999999164011989591126681308736342994607 7
35	1999999999999999999999791002997397781670327074886380910 1
36	19999999999999999999999477507493494454175817618966347436
37	1999999999999999999999986937687337361354395440047598655 7
38	19999999999999999999999967344218343403385988599852396620
39	1999999999999999999999999183605458585084649714994643665 4
40	19999999999999999999999997959013646462711624287485567757
41	1999999999999999999999999948975341161567790607187132685 1
42	1999999999999999999999999987243835290391947651796782764 4
43	19999999999999999999999999968109588225979869129491956656
44	19999999999999999999999999920273970564949672823729891 48
45	19999999999999999999999999980068492641237418205932472 86
46	199999999999999999999999999950171231603093545514831182 1

Hic est Subtensarum Canon; ad cujus usum declarandum, addo unum atque alterum exemplum. Esto radius circuli Quadrantis dati partic. 100000,00000,00000,00000,00000,000; ejusq; arcus ultimus ex secundo Canone $\frac{1}{268435456}$ Quadrantis, respondens bisectioni radii & Quadrantis 28ª. & numero circulorum radii. Ex Canone subtensarum datur subtensa 28ª partic. 199999, 99999, 99999, 96575. 79310, 93652, 548$\frac{9}{10}$ quarum diameter est 200000, 00000, 00000, 00000, 00000, 00000, 0000. Ejus semissis 99999, 99999, 99999, 98287 —— est sinus complementi ultimi arcus. Subtensa verò immediatè præcedens est particul. 199999, 99999, 99999, 86303, 17243, 74610, 196$\frac{9}{10}$; Cujus & Diametri differentia est particul. 13696, 82756, 25389, 803$\frac{1}{10}$, hujusque latus quadratum particul. 11703, 34463, 41372, 77380, subtensa est arcus dupli, Ergo hujus semissis particul. 58516, 72317, 06863, 8690 est sinus rectus arcus ultimi.

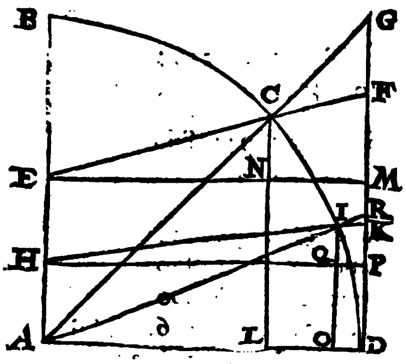
Aliud exemplum; sit dati Quadrantis radius partic. 100000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, ejusq; ultimus arcus ex secundo Canone $\frac{1}{35184372088832}$ Quadrantis, respondens bisectioni Quadrantis 45. & numero circulorum radii. Detur quoque 45 subtensa ex subtensarum Canone particul. 199999, 99999, 99999, 99999, 99999, 98006, 84926, 41237, 41820, 59324, 7286, quarum Diameter est 200000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 0000. Hujus semissis particul. 99999, 99999, 99999, 99999, 99999, 99003 est —— sinus complementi arcus ultimi. Subtensa verò proximè præcedens est particul. 199999, 99999, 99999, 99999, 99999, 92027, 39705, 64949, 67282, 37298, 9148; cujus & Diametri differentia est particul. 79726, 02943, 50503, 27176, 27010, 852; & differentiæ latus quadratum particul. 89289, 43354, 90200, 76626, 66856, 7129, est subtensa arcus dupli. Ergo semissis hujus 44644, 71677, 45104, 88313, 33428, 3564 est sinus rectus arcus ultimi.

Et hi quidem Canones sunt, quorum adminiculo, licet Theorematis nostri veritatem experiri in Radiis majoribus. Nos autem contenti erimus duobus exemplis, nimirum radii particul. 100000, 00000, 00000, 00000, 00000, 000, quo etiam Ludolphus à Collen usus est, & radii particul. 100000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, quo nos primum utemur.

Tertium

Tertium exemplum radii particul.

100000, 00000, 00000, 00000, 00000, 000.



Repetatur præcedens diagramma, sitque A B radius particul. 100000, 00000, 00000, 00000, 00000, 000, & A E ultima pars radii earundem 37252, 90298, 46191, 40625: Item D C arcus ultimus Quadrantis $\frac{1}{268435456}$, & C L ipsius sinus rectus in mensura Radii particul. 58516, 72317, 06863, 8690—— & E N complementi sinus earundem 99999, 99999, 99999, 9828——

Subducatur primum ex sinu

C L 5851672317068638960
L N 37252902984619140625

N C erit 21263820186067246 27

Quare per 4^{m} Sexti Euclidis

Ut E N 99999999999999999828
ad N C 21263820186067246 27
Ita E M 100000000000000000000
ad M F 21263820186067246664. Cui si
addas D M 37252902984619140625

Erit D F 58516723170686387265

Bisecentur porrò A E & arcus D C, eritque A H 18626451492309570312 5, Item D I $\frac{1}{536870912}$ Quadrantis, ejusque rectus sinus I Q 29258361585343193 60, & complementi sinus H Q 99999999999999999957——

Auferatur verò & hîc ex sinu I O, 29258361585343193 60
A H 18626451492309570312 5

reliqua erit Q I 10631910093033623 28

Quare per 4^{m} Sexti Euclidis

Ut H Q 999999999999999999571
ad Q I 10631910093033623 28
Ita H P 1000000000000000000000
ad P K 10631910093033624332. Cui si
addas D P 18626451492309570312 5

Erit D K 29258361585343193632 5.

Itaque & hic recta H I K bisecat D F in K. Est enim

Ut D F 58516723170686387265,
ad D K 29258361585343193632 5.

Ita arcus D C ad arcum D I.

Quare per elementum præmissum D F est æqualis D C, & D K est æqualis D I. Quod erat ostendendum.

Postremum exemplum radii particularum,

100000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000.

Retineatur & hic sthema præmissum, sitque A B radius particul. 100000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, & A E pars radii ultima earundem

 28421,

28421, 70943, 04040, 07434, 84497, 07031, 25; item D C ultimus arcus Quadrantis $\frac{1}{35184372088832}$, ejusque sinus rectus C L in mensura Radii partic. 44644, 71677, 45104, 88313, 33428, 3564; & complementi E N 99999, 99999, 99999, 99999, 99999, 9900.

Auferatur primùm ex sinu

C L	44644716774510488313334283564
L N	28421709430404007434844970703125
relinquitur N C	16223007344106480878489312860

Itaque per 4 Sexti Euclidis

Ut E N	99999999999999999999999999900
ad N C	16223007344006480878489312860
Ita E M	100000000000000000000000000000
ad M F	16223007344106480878489312876. Cui si
addas D M	28421709430404007434844970703125
Erit D F	44644716774510488313334283579125.

Divide verò A E & arcum D C in partes duas æquales, erit A H particular. 14210, 85471, 52020, 03717, 42248, 53515, 625; item D I $\frac{1}{70368744177664}$ Quadrantis, ejusque sinus rectus I O 22322, 35838, 72552, 44156, 66714, 1787 $\frac{9}{10}$, & complementi sinus H Q 99999, 99999, 99999, 99999, 99999, 9975.

Subducatur verò & hic ex sinu

I O	22322358387255244156667141787 $\frac{9}{10}$
A H	142108547152020037174224853515625
reliqua erit Q I	8111503672053240439244656436

Quamobrem per 4 Sexti Euclidis

Ut H Q	99999999999999999999999999975
ad Q I	8111503672053240439244656436
Ita H P	100000000000000000000000000000
ad P K	8111503672053240439244656438. Cui
si addas D P	142108547152020037174224853515625
Erit D K	223223583872552441566671417895625.

Ergo & hic recta H I K bisecat D F in K. Est enim

Ut D F	44644716774510488313334283579125
ad D K	223223583872552441566671417895625

Ita arcus D C ad arcum D I.

Quare per præcedens elementum D F est æqualis D C, & D K est æqualis D I. Quod erat demonstrandum.

Atque ita Theorematis nostri veritas luculenter demonstrata est. Sequuntur jam porismata, quæ ex Theoremate haud aliter quam rivuli ex fonte suo derivantur: Ex quibus de præstantia atque utilitate ipsius Theorematis judicare promptum erit; Imprimis de multiplici usu Tangentis abscissæ, quæ vera est τετραγωνίζουσα, veterumq; τετραγωνιζόμενα, totiusq; Cyclometriæ fundamentum unicum. Enim verò hæc ipsa linea cum peripheria sua affinitatem habet tantam, ut si ambitiosæ & rectæ discrimen excipias, altera alterius naturam induisse videatur. Ut enim peripheria C D major est sinu suo C L, & minor tangente sua D G; ita etiam tangens abscissa D F, major est eodem sinu C L, & minor tangente D G: idque etiam ita est cum peripheria D C, & pars radii A E continuè bisecantur.

Secundò ut peripheria C D eodem modo se habet ad peripheriam dimidiam D I, quo pars radii A E ad partem dimidiam A H; ita etiam tangens abscissa D F se habet ad tangentem abscissam D K, ut pars radii A E, ad partem dimidiam A H: & sic quoque est in

con-

continuis peripheriæ D C, & partis radii A E bisegmentis. Itaque non est dubium, quin altera alteri æqualis sit, saltem in dato circulo: nam si inæquales essent, nequaquam hæc fierent quæ diximus.

Etsi verò etiam sinus & tangentes circa circuli contactum peripheriis suis sint æquales in dato circulo, quemadmodum 4° Theoremate ostendimus, magnum tamen est inter hos, & tangentem abscissam discrimen. Nam tangens abscissa peripheriæ naturam prorsus refert, ut modo probavimus: sinus autem & tangentes referre eam nunquam possunt, quia omnis sinus absolutè perepheria sua semper est minor, & omnis tangens major.

Secundò quoniam Sinus & Tangentes ad circuli contactum peripheriis suis primùm æquales evadunt in dato circulo, usum quidem habent in circuli dimensione quæ fit per numeros, non autem in illa quæ absolvitur per lineas: ratio est, quod ejusmodi sinum aut tangentem peripheriæ suæ adscribere non liceat. Contra quia tangens abscissa, peripheriæ naturam refert, etiam tunc cum quadrantis dimidii intervallo à puncto contactus distat, non modò utrique dimensioni apta est, sed multò ante diametri & peripheriæ rationem in numeris exhibet, quàm sinus aut tangens.

Verùm quia hæc aliaque quæ huc faciunt, ex Theorematis nostri porismatibus maximè erunt perspicua, subiicio porismata ipsa.

PORISMA I.

Hinc licet primò cujuscunque circuli propositi peripheriæ æqualem rectam describere. Quarta enim proportionalis radii parti ultimæ, tangentique abscissæ & radio, est æqualis circuli propositi quadranti, & ipsius quadrupla toti circulo.

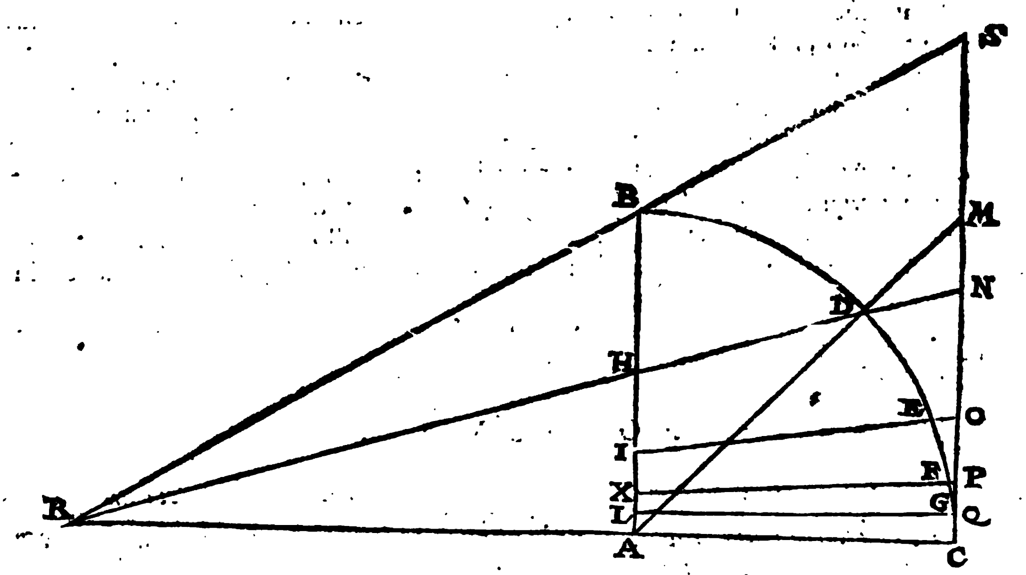
Hic primus est usus tangentis abscissæ, viz. quod ipsius beneficio, cuivis circulo proposito æqualis recta describatur. Cujus Problematis [illegible] à veteribus diu multumque est quæsita, nunquam inventa. Dinostratus enim huic fini excogitaverat [illegible] & Archimedes ordinatam [illegible] utramque tamen lineam inutilem, quod ex ipsorum principiis describi non posset. De Dinostratæa linea res nota est ex Sporo, Pappo, atque aliis; & à nobis infra, volente Deo, demonstrabitur.

At de Archimedæa constabit, si [illegible] instituatur per numeros. Nam si radius circuli, in quo prima helicis conversio absolvitur statuatur particul. 100000, recta eidem peripheriæ æqualis, erit particul. 628318$\frac{1}{2}$, uti suo loco ostendetur. Cùm verò per 18am Archimedis [illegible] recta terminum volutæ contingens, abscindat ab infinita, quæ ex circuli centro per primum quadrantis terminum ducitur, rectam eidem circulo æqualem; necesse est eandem lineam abscissam esse earundem particul. 628318½; angulumque quem linea abscissa subtendit, ex Canone Tangentium grad. 80 57 25. Jam si ex Archimedæis principiis recta sit describenda circuli propositi peripheriæ æqualis, oportet contingentem ita ducere, ut abscissa hunc ipsum angulum exactè subtendat. Nam si angulum subtendat uno tantum primo scrupulo minorem, abscissa linea erit particul. 626654 multo minor justa: sin angulum subtendat uno scrupulo majorem, eadem particul. erit 629006, justa multò major. Atqui cùm ex Archimedæis principiis, contingens sic duci nequeat ut dictum angulum exactè subtendat, utique nec recta per eam obtineri potest, propositæ peripheriæ æqualis.

Nos itaque primi aperimus viam cuicunque circulo proposito, æqualem rectam describendi. Vetus enim illa, quæ utitur ratione diametri & peripheriæ tripla & sesquiseptima, nec veritatis suæ munimentum habet à se, nec omni circulo proposito convenit, sed tantum omnium qui dari possunt minimo. Nostra econtra & robur veritatis à se accipit, & cuivis circulo proposito dimetiendo apta est; Itaque ea ipsa est quæ tot seculis, totque à Geometris summo studio ac labore quæsita fuit, & nunc primùm, summo Dei beneficio est inventa, & præmisso porisinate expressa. Est autem ipsius [illegible] hæc.

Esto circuli propositi quadrans A B C, cujus peripheria B C bisecetur in D, radiusque A B in H: & à puncto bisectionis radii H per bisectionis punctum Quadrantis D ducatur recta H D N in tangentem Quadrantis dimidii D M, quæ ex tangente C M abscindat tan-

tangentem C N. Dico quartam proportionalem ultimæ parti radii A H, tangenti abſciſſæ C N, & radio A B, æqualem eſſe quadranti A B, ſi radius ponatur particul. duntaxat 10, vel 100, utpote circuli omnium minimi. Nam per demonſtrata Pappi eſt, Ut A H ultima pars radii ad D C ultimum arcum Quadrantis, ita A B radius ad B C Quadrantem.



Quoniam autem per Theorema præmiſſum tangens abſciſſa C N eſt æqualis ultimo arcui D C; Per 7 Quinti Euclidis eſt, Ut A H ultima pars radii ad C N tangentem abſciſſam ultimo arcui Quadrantis æqualem, ita A B radius, ad quartam proportionalem, Quadranti B C æqualem. Inventâ igitur quarta proportionali ultimæ parti radii A H, tangenti abſciſſæ C N & radio A B, inventa quoque eſt recta circuli propoſiti Quadranti B C æqualis, quæ poſtulatur.

Invenitur autem ea promptè, ſi recta H D N, & radius A C continuentur, dum ſeſe interſecent in R; & ex R per B terminum radii A B recta R B S ducatur in tangentem C S. Tunc enim per 10ᵐ Sexti ſecatur tangens C S eodem modo in N, ut radius A B in H, adeoque A H A B ſunt proportionales C N C S & per mutando, A H C N, proportionales ſunt A B C S. Itaque Tangens C S eſt quarta proportionalis ultimæ parti radii A H, tangenti abſciſſæ C N, & radio A B; eademque eſt æqualis Quadranti B C, & ipſius quadrupla toti circulo. Deſcripta igitur eſt recta æqualis circulo propoſito. Quod erat faciendum.

Quod ſi verò proponatur circulus major, continuare oportet peripheriæ Quadrantis & radii biſectionem, pro circuli dati magnitudine, atque ultimo arcui æqualem tangentem abſcindere, & in cæteris procedere ut ſupra; ita enim licebit cuivis circulo propoſito æqualem rectam deſcribere, In exemplo, cùm circulus proponitur minimus, quadrans ipſius B C, & radius A B, in duas quatuórve partes æquales ſecantur, ultimoque arcui C D vel C E æqualis abſcinditur tangens C N, vel C O; atque ita datur C S, æqualis quadranti B C, cum ratione diametri & peripheriæ Archimedæa, tripla & ſeſquiſeptima, quæ minimo circulo menſurando ſufficit, non autem majoribus. Verùm ſi circulus proponatur minimo paulò major, oportet ipſius quadrantem & radium dividere in partes æquales octo, ultimoque arcui C F abſcindere æqualem tangentem C P; ſic enim datur C S æqualis Quadranti B C, cum ratione diametri & peripheriæ Ptolemaica, quæ media eſt inter triplam ſeſquiſeptimam, & triplam ſuper partientem decem ſeptuageſimas primas. Quod ſi verò & hoc circulo proponatur paulò major, ipſius quadrans B C & radius A B dividendi ſunt in partes æquales ſexdecim, ultimoque arcui C G, æqualis tangens abſcindenda C Q, hinc enim datur C S æqualis Quadranti B C, cum ratione diametri & peripheriæ ut 10000 ad 31416; qua Viri magni *Georgius Purbacchius*, & *Franciſcus Vieta* ſunt uſi. Licet autem biſectionem peripheriæ Quadrantis & radii hoc modo continuare quoties libet, adeoque

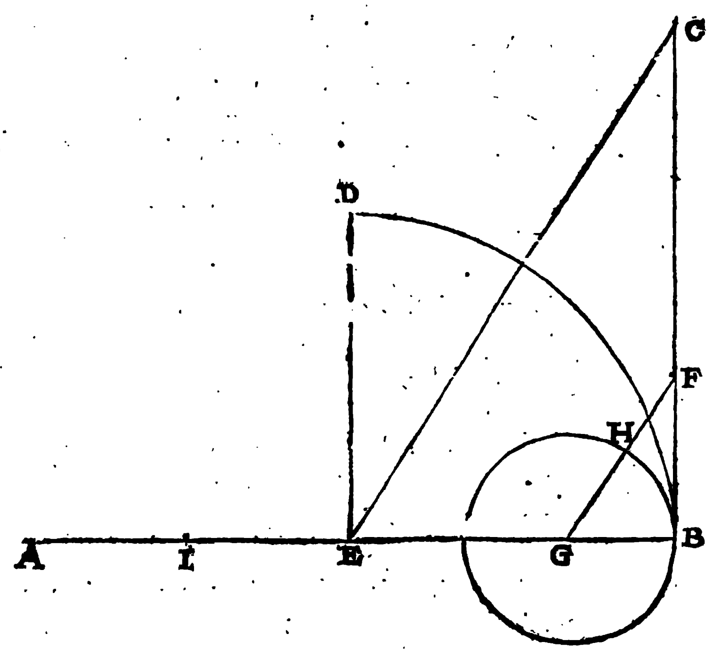
cui-

cuivis circulo proposito æqualem rectam ducere. Cujus problematis constructio, jam totos bis mille & sexingentos annos à Magnis Viris quæsita, à nobis primùm, Dei Opt. Max. beneficio, inventa, jam in omnium conspectum sistitur.

PORISMA II.

Secundò cuivis rectæ datæ describi potest æqualis circuli peripheria, si prius circuli cujusvis quadranti æqualis recta descripta fuerit. Quarta enim proportionalis huic rectæ, radioque circuli, & rectæ datæ quadranti, est radius circuli postulati.

Hoc porisma est superioris conversum, roburque etiam suum à superiore accipit, uti sequens demonstratio docet. Sit enim recta A B data, cui æqualem circuli peripheriam describere oporteat; sitque prius cujusvis circuli Quadranti descripta æqualis recta, per porisma præcedens; exempli gratia in nostro Diagrammate, recta B C æqualis Quadranti D B. Dico quartam proportionalem rectæ B C, radio E B, & A I (quæ est quarta pars datæ A B) esse radium circuli postulati. Nam per demonstrata Pappi est, ut B C recta



Quadranti D B æqualis, ad E B ipsius radium; ita A I (quarta pars A B datæ) æqualis circuli postulati quadranti, ad ipsius radium. Inventa igitur quarta proportionali rectæ B C, radio A B, & A I quartæ parti ipsius A B datæ, obtinetur radius circuli ipsi A B datæ æqualis.

Quarta autem proportionalis dicta promptè invenitur, si ex B C abscindatur B F, æqualis A I, rectæque E C parallela ducatur G F. Quia enim triangula E B C & G B F ex fabrica sunt similia, per 4^{m} sexti est,

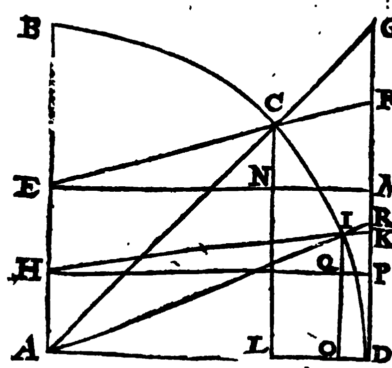
Ut B C ad E B, ita B F ad G B.

Itaque G B est quarta proportionalis B C, E B, & B F; eademque est radius circuli H B A rectæ A B datæ æqualis. Quamobrem rectæ A B datæ descriptus est circulus H B H æqualis. Quod erat faciendum.

PORISMA III.

Tertiò cujuſlibet circuli perimeter dari poteſt in data menſura diametri. Nam ut ſinus rectus complementi ultimi arcus eſt ad differentiam ſinus recti ejuſdem arcus & ultimæ partis radii; ita radius ad differentiam perimetri arcus ultimi, & ultimæ partis radii, quæ cum ultima parte radii, componit perimetrum arcus ultimi. Sed ut ultima pars radii eſt ad perimetrum arcus ultimi, ita radius ad Quadrantis circuli dati perimetrum. Ergo hujus quadruplus eſt dati circuli perimeter.

Expoſita Dimenſione circuli Geometrica quæ fit per lineas, ſequitur Arithmetica quæ abſolvitur calculo. Hujus ſummam complexi ſumus præcedente poriſmate, cujus partes ſunt duæ. Prima calculum proponit perimetri arcus ultimi; Altera Quadrantis perimetri.



Utriuſque fundamentum ex ſequenti demonſtratione manifeſtum eſt. Repetatur diagramma, quo ſupra in demonſtratione Theorematis uſi ſumus; ſitque B C D quadrans circuli, cujus radius ſit datus particul. 100. Quæritur ejuſdem perimeter in data menſura radii. Quia radius A B eſt particul. 100, A H ipſius Quadrans ex fabrica eſt particul. 25: item arcus D I, quarta pars Quadrantis B C D partic. 90, eſt earundem $22\frac{1}{2}$; ejuſque ſinus rectus I O particul. $38\frac{2}{10}$ qualium A B eſt 100; & complementi H Q earundem $92\frac{3}{10}$. Ergo I Q differentia ſinus I O, $38\frac{2}{10}$, & Q O ultimæ partis radii 25 eſt $13\frac{2}{10}$. Hinc datur ex præmiſſo Theoremate D K, perimeter arcus ultimi D I, particul. $39\frac{3}{10}$. Nam ut H Q ſinus complementi arcus ultimi D I partic. $92\frac{3}{10}$ ad I Q $13\frac{2}{10}$ differentiam ſinus I O & ultimæ partis radii O Q; ita H P 100 ad D K $14\frac{3}{10}$ differentiam perimetri ultimi arcus D K, & ultimæ partis radii D P; quæ cum ultima parte radii D P 25 componit D K perimetrum arcus ultimi $39\frac{3}{10}$.

Atqui per 15 Quinti Euclidis,

Ut A H ultima pars radii 25 ſe habet ad D K perimetrum arcus ultimi $39\frac{3}{10}$, ita A B radius 100 ad perimetrum Quadrantis B C D $157\frac{2}{10}$, cujus duplus $314\frac{4}{10}$ eſt perimeter ſemicirculi, puta ſi radius ſit particul. 100; vel circuli perimeter, ſi radius ſit particul. 50.

Atque hæc eſt illa diametri & peripheriæ ratio tripla & ſeſquiſeptima, qua Euclides ſeptuaginta quinque annis ante Archimedem uſus eſt; quamque Archimedes duplici, eaque operoſa demonſtratione comprobavit. Nam per regulam auream eſt

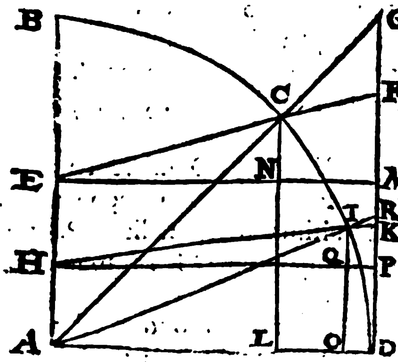
Ut 100 ad $314\frac{4}{10}$, ita 7 ad 22.

Quæ ipſa quoque invenitur ex prima biſectione Quadrantis B C D in C, & radii A B in E. Tunc enim D F eſt perimeter ultimi arcus D C. Atqui jam ante in primo Theorematis noſtri exemplo oſtendimus perimetrum D F eſſe particul. $78\frac{6}{10}$ fere, quarum A B radius eſt 100; itaque perimeter dupli arcus, id eſt quadrantis B C D eſt earundem $157\frac{2}{10}$, omnibus modis ut ſupra.

Cæterum quia iſta diametri & peripheriæ ratio, non convenit omnibus circulis, ſed tantum minoribus, ſubjicio exempla circulorum majorum; ex quibus apparebit, quod de minoribus jam demonſtratum eſt, verum eſſe in majoribus omnibus, etiam in vaſtiſſimis.

Secun-

Secundum exemplum radii particul. 1000.



Repetatur præcedens diagramma, in quo radius A B sit particul. 1000: & A H ultima pars radii earundem 125, nimirum pars radii octava, & D I ultimus arcus grad. 11 15; ejusq; sinus rectus I O ex Canone Sinuum partic. 1950, & complementi H Q 9807, qualium A B radius est 10000 (augemus enim radium datum uno circulo, ut sinus dicti accuratiùs habeantur quod etiam in præmissis exemplis fecimus.) Itaque I Q differentia sinus I O, & ultimæ partis radii Q O est 700. Hinc jam est ex præcedente Theoremate,

Ut H Q sinus rectus complementi ultimi arcus 9807, ad differentiam I Q 700, ita H P 10000 ad K P $713\frac{7}{10}$ differentiam perimetri ultimi arcus D K, & ultimæ partis radii D P; Quæ cum ultima parte radii D P 125, componit perimetrum arcus ultimi D K $1963\frac{7}{10}$.

At per 15^m Quinti Euclidis,

Ut A H ultima pars radii 125, est ad D K perimetrum arcus ultimi $1963\frac{7}{10}$, ita A B radius 1000, ad perimetrum Quadrantis B C D $1570\frac{9}{10}$: Cujus duplus est perimeter semicirculi, & quadruplus circuli perimeter. Itaque semicirculi perimeter est partic. $3141\frac{8}{10}$ quarum radius ponitur 1000. Vel si diameter ponatur particul. 1000, circuli perimeter est earundem $3141\frac{8}{10}$. Ratio autem diametri 1000, ad perimetrum $3141\frac{8}{10}$ est media inter triplam sesquiseptimam, & triplam superpartientem decem septuagesimas primas. Quam Ptolemæus accuratiorem esse testatur, ratione triplà sesquiseptimâ, qua Euclides & Archimedes usi sunt. Vide μεγάλ. συντάξ. librum V I. cap. V I I.

Verùm quia & hæc ratio tantùm deservit circulis, quorum diametri in particulas 1000 commodè dividuntur, non autem majoribus, subjicio tertium exemplum radii particular. 10000.

Tertium exemplum radii particul. 10000.

Manente superiore diagrapha; sit A H ultima pars radii $\frac{2}{16}$, adeoque particul. 625, quarum A B radius est 10000: item D I ultimus arcus quadrantis, sit $\frac{1}{16}$; ejusque sinus rectus I O ex Canone Sinuum particul. 9801, & complementi H Q 99518: qualium A B ponitur 100000: Denique I Q differentia sinus I O & ultimæ partis radii Q O particularum 3551. Hinc datur D K perimeter ultimi arcus D I 9818. Nam per præmissum Theorema

Ut se habet H Q sinus complementi arcus ultimi 99518, ad differentiam I Q 3551, ita H P 100000 ad K P 3568, differentiam perimetri ultimi arcus D K, & ultimæ partis radii D P, Quæ cum ultima parte radii D P conficit ultimi arcus perimetrum D K 9818.

At per 15 Quinti Euclidis,

Ut A H ultima pars radii 625, ad D K perimetrum arcus ultimi 9818 ita A B radius 1000 ad perimetrum Quadrantis B C D $1570\frac{8}{10}$. Cujus duplus 31416 proximè, est perimeter semicirculi, & quadruplus perimeter circuli.

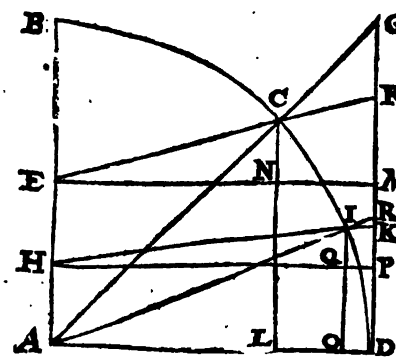
At si diameter propositi circuli statuatur particul. 10000, perimeter ipsius est 31416. Quæ ratio accuratior est illa quam Ptolemæus prodidit, Ut 1 ad 3. 8. 30, hoc est ut 10000 ad 31418. Ut non sine causa eandem proposuerit Magnus Vir *Georgius Purbachius* in tractatu suo de Sinibus; & Illustris Vir *Franciscus Vieta* eadem usus sit in describenda recta circuli dati peripheriæ æquali.

At quoniam nec hæc mensurandis circulis majoribus sufficit, addimus quartum exemplum ex magno Canone Rhetici, Radii scz. particul. 10000000000.

Quartum exemplum radii particul. 10000000000.

Sit itaque in eodem ſchemate radius A B particul. 10000000000, & A H $\frac{1}{1024}$ pars radii earundem 9765625; item I D ultimus arcus Quadrantis $\frac{1}{1024}$; ejuſque ſinus rectus I O 15339801$\frac{1}{2}$ in menſura radii particul. 10000000000; & complementi 9999982342$\frac{1}{2}$. Denique ſinus recti I O, & ultimæ partis radii Q O differentia I Q, particul. 5574176$\frac{1}{2}$. His datis, per præmiſſum Theorema eſt.

Ut H Q ſinus rectus complementi ultimi arcus 9999982342$\frac{1}{2}$ ad I Q differentiam ſinus recti ultimi arcus, & ultimæ partis radii 5574176$\frac{1}{2}$, ita H P radius 10000000000 ad K P 5574183, differentiam perimetri arcus ultimi D K, & ultimæ partis radii D P. Quæ differentia ſi ad ultimam partem radii D P adjiciatur, componitur D K 15339808 perimeter ultimi arcus D I. At per 15 Quinti Euclidis.



Ut A H ultima pars radii 9765625 eſt ad D K ultimi arcus perimetrum 15339808; ita A B radius 10000000 ad perimetrum Quadrantis B C D 1570 7963$\frac{3}{10}$. Cujus duplus 31415926$\frac{6}{10}$ eſt perimeter ſemicirculi.

Verùm ſi diameter ponatur particul. 10000000, circuli perimeter eſt 31415926$\frac{6}{10}$. Quæ diametri & perimetri ratio, accuratiſſima eſt omnium quæ ex magno Canone Triangulorum deducuntur. Ex hypotheſi enim radii particul. 10000000000, (quem idem Canon ſupponit) perimetrum dare licet qui reſpondeat radio particul. 10000000, non autem radio partic. 10000000000. Nam cùm ratio radii ad perimetrum quadrantis colligatur ex ratione partis radii ultimæ ad perimetrum arcus ultimi; perimeter autem arcus ultimi tribus ſaltem notis, à radii dati notis deficiat; oportet etiam quadrantis perimetrum totidem notis à radii notis deficere, ut conſequentes magnitudines, antecedentibus (& quidem ἀλόγοις) reſpondeant. Quamobrem ut hîc, ita etiam in reliquis exemplis omnibus, numero notarum perimetri arcus ultimi, ſemper quadrantis perimetri notarum numerus æqualis eſt ponendus; ita enim ratio radii ad perimetrum quadrantis, reſpondebit exactè rationi ultimæ partis radii ad ultimi arcus perimetrum.

At quia nec hæc diametri & peripheriæ ratio, majoribus circulis convenit, adjicio quintum exemplum radii particul. 100000, 00000, 00000, 00000, 000.

Quintum exemplum radii partic. 100000, 00000, 00000, 00000, 00000, 000.

Repetatur præcedens figura, ponaturquè A B radius particul. 100000, 00000, 00000, 00000, 000; erit A H ultima pars radii earundem 37252, 90298, 46191, 4062$\frac{1}{2}$; item D I ultimus Quadrantis arcus $\frac{1}{268435456}$; & I O ejuſdem ſinus rectùs in menſura radii particul. 58516, 72317, 06863869 --- & H Q complementi ſinus earundem 99999, 99999, 99999, 9828 --- tandemque ſinus recti I O & ultimæ partis radii Q O differentia I Q, particul. 21263, 82018, 60672, 4627. Hinc per præmiſſum Theorema eſt.

Ut H Q ſinus rectus complementi ultimi arcus 99999, 99999, 99999, 9828 --- ad I Q differentiam 21263, 82018, 60672, 4627, ita H P radius 100000, 00000, 00000, 0000, ad K P 21263, 82018, 60672, 4664 differentiam perimetri arcus ultimi D I, & ultimæ partis radii D P. Quæ differentia cum ultima parte radii, componit D K 58516, 72317, 06863, 8726 perimetrum arcus ultimi D I, neglecta fractione $\frac{1}{2}$, quia ſinus ultimi arcus I O, tantum deficit ab ultima parte radii A H.

Ergo per 15^m Euclidis

Ut A H ultima pars radii 37252, 90298, 46191, 4062$\frac{1}{2}$ ad D K 58516, 72317, 06863, 8726

8726 perimetrum arcus ultimi; ita A B radius 100000, 00000, 00000, 000, ad 15707, 96326, 79489, 6619, perimetrum Quadrantis. Cujus duplus 31415, 92653, 58978, 3238 --- est perimeter semicirculi.

At si diameter statuatur particul. 100000, 00000, 00000, 000, circuli perimeter est earundem 31415, 92653, 58978, 3238 ---

Quæ ratio perimetri ad diametrum multò accuratior est illâ quam Clarissimus *Ludolphus à Collen*, in opere suo Cyclometrico, ex ejusdem arcus inscripta & circumscripta demonstravit, nimirum ut 100000, 00000, 00000, 0 ad 31415, 92653, 58978, 32 minorem justà; & 31415, 92653, 58978, 33 justà majorem. Utraque enim duabus ultimis notis deficit à nostra. Apparet itaque verum esse quod supra diximus, rationem diametri & peripheriæ citiùs, accuratiusque obtineri per ultimi arcus tangentem abscissam, hoc est per nostram περιγωνίζουσι, quàm per ejusdem arcus inscriptam & circumscriptam: ideoque nostram Cyclometriam, Archimedæa (qua *Ludolphus* usus est) ἀκριβεστέραν, magisque compendiosam esse. Nam quod Archimedæam nonnulli nostræ præferendam esse existimant, quod ea ultimam perimetri notam perpetuò concludat intra duos terminos majorem & minorem, nostra verò hoc faciat nunquam: error est, quia & nostra hoc ipsum cum Archimedæa perpetuò facit. Enimverò Cyclometria nostra ultimam notam semper dat exactè, quemadmodum in præcedente exemplo demonstravimus: est itaque sine fractione, justà semper minor; & cum fractione, vel cum unitate, perpetuò justà major. In exemplo, si detur Diameter partic. 10000000, perimeter major est quàm 31415926, & minor quam 31415927, vel etiam quam 31415926$\frac{6}{10}$. Item si diameter detur partic. 100000, 00000, 00000, 000, perimeter major est quam 31415, 92653, 58978, 3238, & minor quàm 31415, 92653, 58978, 3239. Atque ita in cæteris; si modò numerus notarum perimetri Quadrantis, æqualis sit numero notarum perimetri arcus ultimi.

Quoniam verò neque ista Diametri & Perimetri ratio, locum habet in circulis majoribus, addo sextum exemplum radii Vastissimi, particul. 100000, 00000, 00000, 00000, 00000, 00000, 00000, 000000, 00000.

Postremum exemplum radii particular.

100000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000.

Esto A B radius in adjuncto Diagrammate partie. 100000, 00000, 00000, 00000, 00000, 00000, 00000, 00000, 00000; erit A H ultima pars radii earundem 28421, 70943, 04040, 07434, 84497, 0703$\frac{1}{8}$, & D I ultimus arcus Quadrantis 3, 18437, 20888, 32, ejusque sinus rectus I O in mensura radii particul. 44644, 71677, 45104, 88313, 33428, 3564; & complementi H Q sinus 99999, 99999, 99999, 99999, 99999, 9900; item recti sinus I O, & ultimæ partis radii Q O differentia I Q particul. 16223, 00734, 40064, 80878, 48931, 2860. Ergo per Theorema præmissum est.

Ut H Q sinus rectus complementi ultimi arcus 99999, 99999, 99999, 99999, 99999, 9900, ad differentiam I Q 16223, 00734, 4064, 80878, 48931, 2860, ita H P radius 100000, 00000, 00000, 00000, 00000, 000, ad K P 16223, 00734, 40064, 80878, 48931, 2876, differentiam perimetri arcus ultimi D K, & ultimæ partis radii D P. Quæ differentia cum ultima parte radii componit perimetrum arcus ultimi D K partic. 44644, 71677, 44104, 88313, 33428, 3579, omissa fractione ultimæ partis radii $\frac{1}{8}$, quia sinus ultimi arcus F O, tantundem deficit ab ultima parte radii.

Itaque per 15 Quinti, ut A H ultima pars radii 28421, 70943, 04040, 07434, 84497, 0703$\frac{1}{8}$ ad D K 44644, 71677, 44104, 88313, 33428, 3579; ita A B 100000, 00000, 00000, 00000, 00000, 000, ad 15707, 96326, 79849, 66192, 31321, 6916$\frac{4}{10}$. Cujus duplus 31415, 92653, 58979, 32384, 62643, 3832$\frac{8}{10}$ est semicirculi perimeter. Itaque οἵων μοιρῶν, ut Ptolemæus loquitur, οἵων ἡ διάμετρος 10000000000000000000000000000, τοιούτων ἐστὶν ἡ περίμετρος 31415926535897932384626433832$\frac{8}{10}$ ἔγγιστα.

Et hæc quidem exempla sufficiunt illustrando Theorematis nostri porismati tertio; eademque perspicuè docent quomodo in terminis multo majoribus, ratio Diametri ad peri-

perimetrum definiri possit, si modò Canon Subtensarum ad plures particulas sit subductus. Cujusmodi est quem magnus Logista *Ludolphus à Collen* supputavit ad Diametri circulos 75. Verùm quia tam infiniti numerorum anfractus, nec usum habent ullum, nec ad Cyclometriæ perfectionem ullo modo faciunt, non libet nobis ultra λεπτολεσχῶν. Omnino enim nos cum Medicorum principe statuimus, ὁπόσοις τῶν ἐπιτηδευμάτων οὐκ ἔνι τὸ τέλος βιωφελὲς, τούτων οὐκ ἄνευ τέχνας. Ideoque numeris quos supra exposuimus, contenti sumus.

Porrò etsi ex iis quæ hucusque demonstrata sunt, cuivis judicare promptum sit, quantum Cyclometria nostra super Archimedæam caput efferat, ut tamen ipsa rei veritas sit magis conspicua, exponam paucis, quid inter nostram, & Archimedæam intersit. Archimedes tertia propositione μετρήσεως κύκλου demonstrat cujusvis circuli peripheriam rationem habere ad Diametrum minorem tripla sesquiseptima, & majorem tripla superdecupartiente septuagesimas primas. Unde infert justam peripheriæ & Diametri rationem intra terminos illos conclusam esse. Hoc quamvis adeo sit verum, ut qui negare audeat, ex Mathematicis Scholis tanquam ἀγεωμέτρητος eliminari mereatur: quia tamen Cyclometria ex eo ratiocinio deducta, crassior est quam Geometriæ subtilitas fert, non videtur absolutè Geometrica esse.

Manifestum enim est ex iis quæ supra demonstrata sunt perimetrum arcus ultimi esse ad ejusdem arcus sinum, ut idem arcus ad eundem sinum. Quomodò igitur ultimi arcus sinus Geometricè datur, ita quoque dare oportet, arcus ultimi (adeoque & circuli ipsius) perimetrum. Atqui Ptolemæus libro magni operis I. cap. IX. ubi ex Hipparchi & Menelai sententia quantitates subtensarum Geometricè demonstrat, non cogit eas intra duos limites majorem & minorem, sed determinat singulas in assumpta mensura diametri, exactè si rationales sint, vel ἔγγιστα si irrationales. Eadem itaque ratione peripheriæ Quantitas in assumpta mensura diametri danda est, non autem intra duos terminos concludenda.

Nam ut exemplo rem declarem, Si quis sinum semiquadrantis pronunciet majorem esse quam $\frac{70}{100}$, & minorem quam $\frac{71}{100}$, verum quidem dicet, sed ex arte sinum semiquadrantis non dabit; cùm potius ex Ptolemæi doctrina pronunciare debeat, sinum semiquadrantis esse particul. 7071068 fere, qualium radius est 10000000. Atque ita etiam in dimensione circuli est procedendum. Nam si dati circuli peripheriam ex arte metiri libeat, non oportet cum Archimede pronunciare rationem peripheriæ ad diametrum inter $3\frac{10}{70}$ & $3\frac{10}{71}$ comprehensam esse, sed potius affirmare cum Ptolemæo, circuli peripheriam esse partic. 3. 8. 30, qualium diameter est 1. lib. μεγάλ. συντάξ. VI. cap. VII. vel ex nostra doctrina accuratius, peripheriam circuli esse part. 31416, proxime, qualium Diameter est 10000.

Sed & alterum in Archimedæo ratiocinio animadvertendum est, viz. quod limites $3\frac{10}{70}$ & $3\frac{10}{71}$ latè nimis dissideant. Ex priore enim limite colligitur ratio Diametri ad peripheriam ut 10000 ad 31428 ---- ex altero ut 10000 ad 31408 ---- at quæ inter has est media scz. ut 10000 ad 31418 ----: haud satis est accurata. Supra enim in tertio nostro exemplo ostensum est diametro particul. 10000 deberi perimetrum particul. 31416 proximè; itaque perimeter particul. 31418, non est justus. Atque hoc est quod observavit ante nos, Apollonius Pergæus magnus Geometra, qui non modò postulavit diametri & peripheriæ rationem Archimedæa accuratiorem, sed ut Eutocius Ascalonita testatur, ἀπέδειξεν αὐτὸ δι' ἀριθμῶν ἑτέρων ἐπὶ τὸ σύνεγγυς μᾶλλον ἀγάγων. Idem fecit Philo Gadarenus, quem idem Eutocius affirmat εἰς ἀκριβεστέρους ἀριθμοὺς ἀγάγειν τῶν ὑπ' Ἀρχιμήδους εἰρημένων τοῦτε ζ φημὶ καὶ τῶν κβ. Et Ptolemæus libro μεγάλ. συντάξ. VI. cap. VII. Archimedæam rationem ut simpliciorem rejicit, & suam substituit, ut 1 ad 3. 8. 30. Et nostro tempore priscos omnes antecedens incomparabilis Logista Ludolphus à Collen demonstravit peripheriam circuli cujus diameter ponitur particular. 100000000000000000000, majorem esse quam 314159265358979323846, & minorem quam 314159265358979323847. Cujus vestigiis etiam nos insistentes ostendimus circuli cujus diameter est 10000000000000000000000000000, perimetrum esse minorem quam $31415926535897932384626433832\frac{8}{10}$, & majorem quam 31415926535897932384626433832.

Sequitur verò tertium in Archimedæo ratiocinio notandum, nimirùm quod ratio diametri & peripheriæ tripla & sesquiseptima, hoc est ut 7 ad 22, quæ tantum servit dimensioni circuli minoris, puta cujus diameter ponitur particul. 100, perperam propositione μετρήσεως κύκλου secunda majorum circulorum dimensioni adhibeatur. Licet enim ex ratione peri-

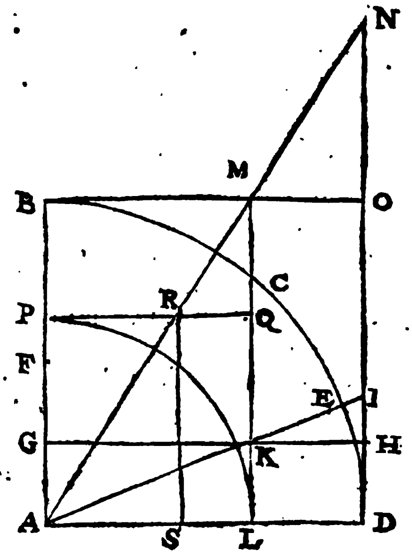
peripheriæ & diametri majoris, minoris quantitatem colligere, sed non contra ex ratione minoris, quantitatem majoris. In exemplo, ex ratione diametri & peripheriæ ut 10000, ad 31416 proximè, rectè infertur ratio diametri & peripheriæ ut 100 ad 314. Est enim per regulam auream, ut 10000 ad 31416, ita 100 ad 314. Ex hac verò non sequitur illa, quia per eandem regulam est, ut 100 ad 314, ita 10000, ad 31400, quæ minor est justâ. Eodem modo ex ratione diametri & peripheriæ, ut 10000 ad 31416, sequitur ratio tripla sesquiseptima proximè; nam ut 10000 ad 31416, ita 7 ad 22 ferè. At non ex ratione tripla & sesquiseptima sequitur ratio Diametri 10000 ad Perimetrum 31416; est enim ut 7 ad 22, ita 10000 ad 31428, quæ particulis 12 illa est major. Itaque ne Cyclometria sit mendax, oportet vel ex ratione diametri & peripheriæ majoris data, inferre quantitatem minoris; vel circuli dati perimetrum ex præsenti porismate determinare in data mensura diametri; utrumvis enim fiat, Cyclometria erit vera.

Sed hæc quidem præcipua sunt quæ in Archimedæo ratiocinio animadvertenda esse existimamus; ex quibus judicare licet de Cyclometriæ nostræ præstantia. Quæ enim in Archimedæa desiderantur, reperiuntur in nostra: & quæ demonstratione operosa ab Archimede adstruuntur, facili & perspicua ἀποδείξει à nobis expediuntur. Reliquum est ut in Cyclometria Dinostrati deinceps tentemus, quod in Archimedæa, Deo juvante, fecimus & perfecimus.

6. *Si in dati circuli quadrante ab ultimo sectionis radii erecti puncto, recta πρὸς ὀρθὰς ducatur in tangentem ultimo arcui æqualem, & ex centro quadrantis in dictæ tangentis terminum alia recta agatur priorem secans; perpendicularis à puncto sectionis in radium abscindet basin τετραγωνιζούσης Dinostrati.*

Inter lineas quæ Geometrarum scriptis celebrantur, duæ primum locum obtinent, Admirabilis & τετραγωνίζουσα. Pappus admirabilem tribuit Menelao: τετραγωνίζουσαν verò idem Pappus cum Proclo attribuunt Dinostrato, Nicomedi, Hippiæ. Conati autem sunt magni illi Viri τετραγωνίζουσαν describere per duos motus imaginarios, radii scz. & lineæ contra basin Quadrantis parallelæ; quæ dum motu ὁμαλῷ & ἰσοχρονίῳ procedunt, radius quidem Quadrantem & parallela radium erectum percurrendo, quacunque earum communis sectio procedit, linea ducitur, quæ ab officio τετραγωνίζουσα appellatur, quia scz. excogitata fuit ad circulum quadrandum. Id verò inventum reprehendit Pappus quia principium petit. Cùm enim potissimùm ei fini comparatum sit ut punctum τετραγωνίζον definiat, idque prius evanescat quàm inventum sit, neque ulla ratione ex Dinostrati principiis obtineatur, rectè eam rejicit Pappus, ut inutilem, & quæ describi non possit.

Tentavit superioribus annis Doctissimus Clavius eandem describere per puncta radii: & parallelę sese intersecantium (quod tamen artificiū magnos illos Viros non latuit) sed conatu irrito: quia ut Sporus Nicenus animadvertit, & Clavius ipse fateri cogitur, ipsius τετραγωνιζούσης finis eo modo nunquam deprehenditur.



Nos itaque primi aperimus viam terminum lineæ τετραγωνιζούσης deprehendendi; eamque munimus demonstratione sequenti.

In adjuncta figura, esto circuli dati quadrans A B C D inscriptus quadrato A B O D, cujus peripheria B C D sit continuè bisecta, primùm in C, secundò in E, bisectus quoque sit eodem modo radius A B, primùm in F, secundò in G; Deinde per præmissum Theorema describatur recta D I, æqualis arcui ultimo E D. Tandem ex G ultimo bisectionis radii puncto agatur normalis G H in tangentem D I, & ex A centro quadrantis, mittatur alia recta A I in terminum tangentis D I, secans priorem G H in puncto K. Dico A L partem radii AD quam abscindit perpendicularis K L à puncto sectionis K in radium AD, esse basin τετραγωνιζούσης Dinostrati.

Con-

Continuetur enim K L in M, & ex A centro ducatur recta A N per punctum M in tangentem D N, eruntque triangula A L M & A D N similia, propter rectos angulos ad L & D, communem ad A: ideoque per 4^m^ Sexti Euclidis.

Ut A L ad L M, ita A D ad D N.

Est autem D N æqualis quadranti B C D. Nam per 15 Quinti Euclidis.

Ut K L quarta pars radii, ad I D rectam æqualem quartæ parti Quadrantis B C D, ita L M id est A B radius, ad D N rectam æqualem Quadranti B C D. Ergo per 7 Quinti

Ut A L ad L M radium, ita A D radius ad quadrantem B C D: adeoque recta A L, radius L M, & quadrans B C D sunt continuè proportionales.

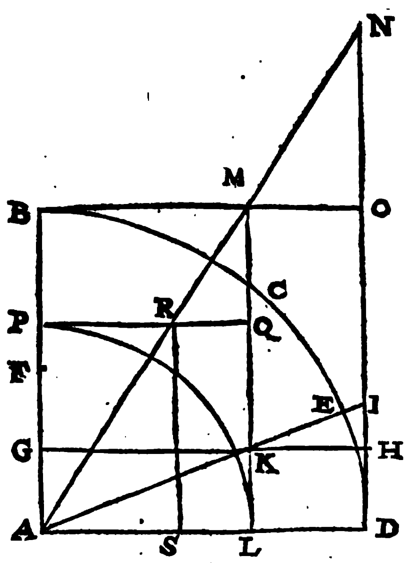
Demonstravit verò Dinostratus basin τετραγωνιζούσης, radium, & peripheriam Quadrantis continuè proportionales esse. Quamobrem cum pars radii abscissa A L, radius A D, & peripheria B C D continue proportionales sint; sequitur partem radii abscissam A L esse basin τετραγωνιζούσης dinostrati. Quod erat demonstrandum.

P O R I S M A.

Itaque tertia proportionalis basi τετραγωνιζούσης, & dati quadrantis radio, peripheriæ dicti quadrantis æqualis est.

Quia enim ex dinostrati demonstratis, basis τετραγωνιζούσης est ad radium, ut radius ad peripheriam Quadrantis; & ex nostri Theorematis ἀποδείξει, basis τετραγωνιζούσης est ad radium, ut radius ad tertiam proportionalem; manifestum est peripheriam Quadrantis & tertiam proportionalem habere eandem rationem ad radium; atque adeò per 9. Quinti Euclidis peripheriam Quadrantis & tertiam proportionalem inter se æquales esse.

Apparet autem ex præsenti porismate, quomodo basis τετραγωνιζούσης Dinostrati beneficio, cujusvis circuli Quadranti dato recta æqualis describi possit, & cuivis rectæ datæ æqualis peripheriæ Quadrans. Primò enim, si recta sit ducenda æqualis dato peripheriæ quadranti: oportet per præsens Theorema, à radio Quadrantis dati auferre basin τετραγωνιζούσης, deinde basi τετραγωνιζούσης & radio invenire tertiam proportionalem, ea enim per præsens porisma æqualis est dato peripheriæ Quadranti.



Exempli gratia, in præcedente schemate, D N tertia proportionalis basi τετραγωνιζούσης A L & radio A D, æqualis est peripheriæ Quadranti B C D.

Contra si quadrans peripheriæ sit decircinandus æqualis rectæ datæ; oportet describere quemcunque circuli Quadrantem, rectamque invenire, per Theorema præsens, peripheriæ Quadrantis descripti æqualem. Quâ obtentâ, reperienda est quarta proportionalis, rectæ inventæ, radio Quadrantis descripti, & rectæ datæ; ea enim est radius Quadrantis circuli postulati. In exemplo, si in eodem schemate detur recta L M, cui æqualem circuli Quadrantem describere oporteat; ubi quadrans A B C D ὡς ἔτυχε descriptus fuerit, rectaque D N reperta peripheriæ B C D æqualis, invenienda est A L quarta proportionalis rectæ D N, radio A D, & datæ rectæ L M; ea enim est radius circuli Quadrantis A P L, ejusque peripheria P L est æqualis datæ rectæ L M. Quæ fuere præstanda.

7. Si

7. *Si tertia proportionalis dicta fiat circuli radius, radius Quadrantis dati erit basis τετραγωνιζούσης.*

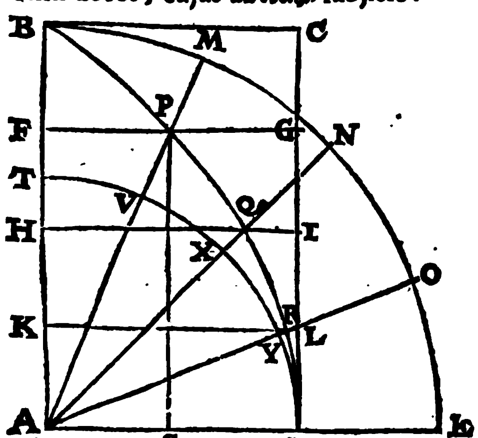
Manente superiore Diagrapha, sit datus circuli quadrans A P L, & M L tertia proportionalis basi τετραγωνιζούσης A S & radio R S, id est A L: fiat autem M L id est A D radius Quadrantis circuli B C D; Dico A L radium circuli quadrantis A P L esse basin τετραγωνιζούσης. Est enim per 4^m Sexti Euclidis.

Ut A L ad M L, ita A D ad D N.

Quamobrem cùm D N sit tertia proportionalis radio A D, & A L manifestum est ex Theoremate præmisso A L esse basin τετραγωνιζούσης. Quod erat ostendendum.

8. *Si rectangulum dati circuli quadrantis radio & tertia proportionali dicta contentum describatur, ejusq; latera majora in quotvis partes æquales dividantur, quadransque circuli tertiæ proportionalis radio descriptus in partes æquales totidem; deinde per puncta divisionum laterum majorum parallelæ ducantur, radiiq; in puncta sectionum quadrantis: ubi horum singuli secant illarum singulas, puncta sunt lineæ τετραγωνιζούσης Dinostrati, lineaq; uniformiter per ea in terminum basis τετραγωνιζούσης ducta, est ipsa linea Dinostrati optata.*

Admiranda est natura lineæ τετραγωνιζούσης, quia non modò per eam circulus quadratur, & peripheria circuli in rectam lineam extenditur, sed & multa alia perficiuntur quæ magnum usum habent in Geometria, & scitu perjucunda sunt. Rejecta quidem est ea ipsa linea à Pappo Alexandrino, & Sporo Niceno tanquam inutilis, sed non aliam ob causam; quàm quod eos via lateret ipsius terminum deprehendendi: quo latente ipsa linea revera est inutilis. Verùm quia 6 Theoremate via nobis munita est, terminum τετραγωνιζούσης obtinendi, non potest non expedita esse ipsius lineæ descriptio, sicuti præmissum Theorema docet, cujus ἀπόδειξιν subjicio.



Describatur rectangulum A B C D contentum dati circuli quadrantis radio A D, & tertia proportionali A B, lateraq; A B & C D majora dividantur in quatuor partes æquales; quadransque A B E, descriptus radio tertiæ proportionalis A B in partes æquales totidem: deinde per puncta divisionum laterum majorum, ducantur parallelæ F G, H I, K L, radiique A M, A G, A O, per puncta sectionum quadrantis. Ubi autem radius A B secat parallelam B C, & radius A M parallelam F G, item radius A N parallelam H I, denique radius A O parallelam K L, nimirum in signis B, P, Q, R, sunt puncta lineæ τετραγωνιζούσης Dinostrati, lineaque B P Q R D per ea uniformiter ducta in terminum basis τετραγωνιζούσης D, est ipsa linea Dinostrati optata. Nam radius A B circa centrum A per peripheriam B M N O E eodem tempore movetur æquali motu, quo latus B C itidem æquali motu fertur deorsum per latera A B & C D, idque prorsus ut Dinostratus imaginatus est. Hinc fit, ut quando radius A B pertransivit quamcunque partem arcus B M N O E, tunc latus B C æquales partes laterum A B, D C percurrerit. Habet enim & hìc locum prima Archimedis propositio in Helicibus, *Si punctum lineas æquevelociter permeaverit, spacia permeata erunt æqualia temporibus.* Unde etiam manifestum est lineam τετραγωνίζουσαν Dinostrati esse ex familia Helicum, ut rectè judicavit incomparabilis vir *Iosephus Scaliger*. Enimverò ordinata Helix Cononis aut Archimedis describitur à puncto quod æquevelociter percurrit circuli radium & peripheriam;

P ita

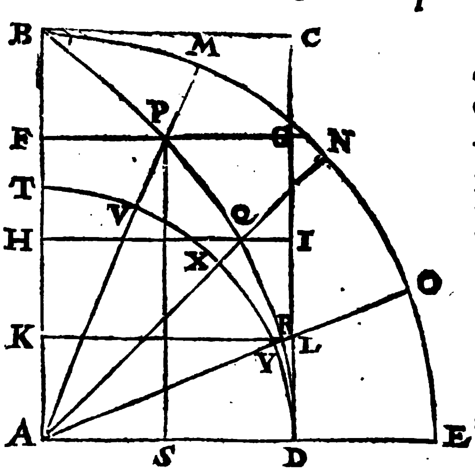
ita etiam τετραγωνίζουσα deſcribitur à puncto quod æqueveloci motu permeat latera A B, D C, & peripheriam Quadrantis B M N O E. Diſcrimen tamen inter utramque manifeſtum eſt. Ordinata enim Helix æqualibus radii decrementis deſcribitur, at τετραγωνίζουσα decrementis inæqualibus, nimirum A B, A P, A Q, A R, A D, ut non ſine cauſa idem Scaliger exiſtimarit τετραγωνίζουσαν eſſe ἕλικα παραλελυμένην hoc eſt, volutam luxatam aut delumbatam. Non ſentimus autem cum ipſo deſcriptionem τετραγωνιζούσης, ſolo quadrantis intervallo perficiendam eſſe: τετραγωνίζουσα enim peculiarem circinum vendicat, cujus loco ſi Mechanicus circuli circino velit uti, præſtabit inæqualia intervalla A B, A P, A Q, A R ſumere, quàm unicum intervallum A B; niſi malit per tria quævis puncta arcus ducere, atque ita τετραγωνίζουσαν complere.

P O R I S M A.

Licet igitur circuli cujuſvis dati quadranti τετραγωνίζουσαν adſcribere.

Nam per 6 elementum datur tertia proportionalis baſi τετραγωνιζούσης & radio Quadrantis dati: per præſens autem elementum deſcribitur rectangulum tertia proportionali & radio quadrantis dati contentum, item circuli quadrans tertiæ proportionalis intervallo: atque hinc tandem τετραγωνίζουσα ipſa.

9. *Si quadranti dato adſcripta ſit τετραγωνίζουσα perpendicularis à quocunque* τετραγωνιζούσης *puncto in baſin, æqualis eſt arcui quem recta, ex centro quadrantis ducta in* τετραγωνιζούσης *punctū, abſcindit ex dicto peripheriæ quadrante.*



Repetatur ſuperius diagramma; ſitq; A T D datus circuli quadrans, & B P Q R D *tetragonizouſa* eidem adſcripta: ducatur quoque recta A P ex A centro Quadrantis in P punctū *tetragonizouſ*ꝭ. Dico perpendicularē P S à puncto *tetragonizouſ*ꝭ P, in A D baſin, æqualem eſſe arcui D V, quem recta A P abſcindit in quadrante D T. Quoniam enim P S id eſt F A, talis pars eſt ipſius A B ex conſtructione, qualis E M eſt ipſius E B, vel D V ipſius D T; A B autem per conſectarum 6 elementi, æqualis eſt quadranti D T; eſt etiam per 11 Quinti Euclidis P S æqualis arcui D V. Quod erat demonſtrandum.

P O R I S M A P R I M U M.

Hinc primò reperire poſſumus circuli cujuſvis arcui dato rectam æqualem, ſi modò Quadranti circuli dati tetragonizouſa *adſcripta fuerit. Nam ſi datus arcus ſit circuli quadrans, tertia proportionalis eſt æqualis arcui dato. At ſi arcus datus quadrante ſit minor, ubi per terminum dati arcus in* tetragonizouſa *recta emiſſa fuerit, perpendicularis à puncto ſectionis* tetragonizouſꝭ *in baſin, eſt arcui dato æqualis. Si verò datus arcus major fuerit circuli quadrante, reperienda primùm eſt recta æqualis quadranti, vel ſemicirculo, vel tribus quadrantibus; deinde alia recta æqualis reliquo arcui qui minor eſt quadrante. Nam duæ hæ rectæ conjunctæ ſunt toti arcui dato æquales.*

Iteretur & hic præcedens figura; eſtoque circuli dati quadrans T D, & *tetragonizouſa* eidem adſcripta B P Q R D. Jam ſi arcus datus ſit quadrans D T, æqualis ei recta erit A B, eſt enim perpendicularis à termino *tetragonizouſ*ꝭ B in baſin A D. Quod ſi detur arcus V D,

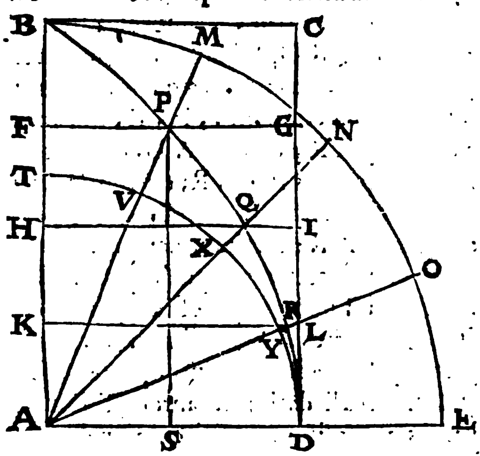
erit

erit ei æqualis perpendicularis P S demiſſa ex P puncto τετραγωνιζούσης in baſin A D: recta enim A P ex A centro Quadrantis ducta per V terminum arcus dati ſecat τετραγωνίζουσαν in P. Poſtremo ſi detur quadrans T D & arcus V D ſimul, erit ei æqualis recta A B & P S ſimul. At ſi duo vel tres Quadrantes dentur in propoſito circulo, unà cum arcu V D, erit ei æqualis recta A D vel bis vel ter ſumpta, cum recta P S ſemel. Quæ erant præſtanda.

PORISMA SECUNDUM.

Secundò cuilibet rectæ datæ abſcindere poſſumus æqualem arcum ex dato quovis circulo, cujus circumferentia non eſt minor quàm recta data; ſi priùs dati circuli quadranti τετραγωνίζουσα *fuerit adſcripta. Nam ſi recta data æqualis fuerit tertiæ proportionali, quadrans circuli dati æqualis eſt rectæ datæ. Quod ſi minor fuerit recta data quam tertia proportionalis, oportet ex ea abſcindere rectam datam & à termino abſciſſæ parallelam baſi* τετραγωνιζούσης *ducere in* τετραγωνίζουσαν, *rectamq; ex centro quadrantis in punctum concurſus parallelæ &* τετραγωνιζούσης, *arcus enim quadrantis quem eadem recta abſcindit, eſt datæ rectæ æqualis. Tandem ſi recta data major fuerit quam tertia proportionalis, abſcindere oportet hanc ex illa quoties licet, vel ſemel, vel bis, vel ter, reperiendusq; eſt arcus reliquæ æqualis, ut ſupra. Hic autem vel uni, vel duobus, vel tribus quadrantibus conjunctus, prout vel ſemel, vel bis, vel ter, tertia proportionalis ex data recta abſciſſa fuit, componit arcum datæ rectæ æqualem.*

In eodem ſchemate, Eſto dati circuli quadrans T D, eique adſcripta τετραγωνίζουσα B P Q R D: ſitque primum recta data æqualis tertiæ proportionali A B, erit ei æqualis quadrans T D, ut ſupra demonſtratum eſt.



Quod ſi data recta ſit æqualis ipſi A F, adeoque minor tertia proportionali A B; oportet eam ex A B abſcindere, & ex ejus termino F baſi τετραγωνιζούσης A D parallelam F P ducere in τετραγωνίζουσαν, & à puncto P concurſus parallelæ & τετραγωνιζούσης perpendicularem P S demittere in baſin; deinde ex A centro rectam ducere in P, quæ per præſens elementum abſcindet ex T D Quadrante arcum V D æqualem rectæ datæ. Poſtremò, ſi data recta ſit æqualis tertiæ proportionali A B & rectæ A F ſimul, oportet hanc abſcindere ex A B, & invenire arcum æqualem reliquæ, nimirum arcum V D: hic enim conjunctus cum quadrante T D, æqualis erit rectæ datæ. Quod ſi recta data vel bis, vel ter metiatur A B, & rectam A F ſemel, oportet Quadrantem T D vel bis, vel ter conjungere arcui V D, prout recta data vel bis vel ter metitur A B, eumq; addere arcui V D, eruntq; hi arcus conjuncti rectæ datæ æquales. Quæ facienda erant.

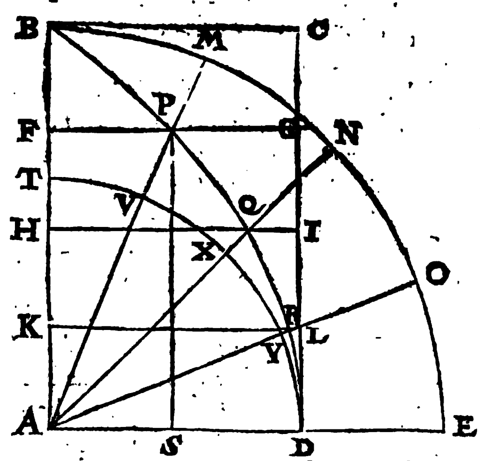
PORISMA TERTIUM.

Tertio datum circuli arcum dividere licet in proportionem datam, ſi dati circuli quadranti τετραγωνίζουσα *fuerit adſcripta. Nam ſi arcus datus fuerit circuli quadrans oportet tertiam proportionalem dividere in proportionem datam, & ex puncto diviſionis parallelam baſi* tetragonizous·s *ducere in* tetragonizouſan, *rectamq; ex centro quadrantis in punctum concurſus parallelæ &* tetragonizous·s; *hæc enim ſecabit circuli quadrantem in proportionem datam.*

 Quod

Quod si datus arcus duobus quadrantibus, vel tribus, vel quatuor æqualis fuerit, secare oportet unum quadrantem in proportionem datam, & duplos arcuum sectorum sumere, si datus arcus duos quadrantes æquaverit; vel triplos, si tres; vel quadruplos, si quatuor. Dupli enim dividunt duos quadrantes, tripli tres, quadrupli quatuor, ut simplus unum.

At si arcus datus minor sit quadrante, oportet rectam ducere in τετραγωνίζουσαν per terminum arcus dati, & ex puncto sectionis τετραγωνιζούσης perpendicularem in basin, & æqualem ei abscindere ex tertia proportionali: Hæc deinde in proportionem datam secanda est; & ex punctis sectionum parallelæ basi ducendæ in τετραγωνίζουσαν, rectæque ex centro quadrantis per puncta intersectionum parallelarum & τετραγωνιζούσης; hæ enim arcum datum dividunt in proportionem datam. Si verò datus arcus sit quadrante major, secetur primum quadrans, deinde reliquus arcus in proportionem datam, & secti arcus conjungantur; ita datus arcus in datam proportionem sectus erit. Denique si datus arcus sit quadrantibus duobus vel tribus major; secandi primum sunt vel duo quadrantes, vel tres in proportionem datam, deinde arcus reliquus; nam & hi conjuncti propositum arcum in datam proportionem divident.



Datus esto in eadem diagrapha quadrans T D, quem dividere oporteat in proportionem datam, puta quadruplam, sitque ei adscripta τετραγωνίζουσα B P Q R D. Dividatur primum tertia proportionalis A B in partes æquales quatuor, deinde ex punctis sectionum F, H, K, ducantur rectæ F P, H Q, K R parallelæ A D, quæ secent τετραγωνίζουσαν in punctis P, Q, R; tandemq; ex A centro agantur in puncta sectionũ τετραγωνιζούσης rectæ A P, A Q, A R; secabunt hæ quadrantem T D datum in proportionem quadruplam. Nam A B ex præsenti Theoremate est æqualis Quadranti T D, & partes A B partibus T D. Cùm igitur partes A B quadrantes sint, oportet etiam partes T D quadrantes esse; adeoque rectam A B, & circuli dati quadrantem T D divisum esse in proportionem quadruplam. Quod si arcus propositus, semicirculo, vel tribus Quadrantibus, vel etiam semicirculo æqualis fuerit, oportet nihilominus Quadrantem ut supra secare in proportionem quadruplam, sed si semicirculum eodem modo dividere libeat, sumendus est duplus ipsius D Y, viz. D X, hic enim est semicirculi quadrans. Aut si peripheria tribus quadrantibus constans eodem modo secanda sit, triplus arcus, nimirum D V est capiendus, Nam & hic tres Quadrantes circuli una peripheria contentos dispescit in proportionem quadruplam. Tandem si circulus eodem modo dividendus sit, sumendus est quadruplus arcus D T: hic enim quia est dati circuli quadrans, utique eundem circulum secat in proportionem eandem. At si detur arcus V D, minor Quadrante circuli T D, isque dividendus sit in proportionem triplam; oportet rectam ducere ex A centro quadrantis per V terminum arcus dati, quæ τετραγωνίζουσαν secabit in puncto P, ex quo demittenda est perpendicularis P S in basin A D, & ex A B abscindenda est A F æqualis P S. Hæc deinde dividenda est in proportionem triplam, & ex punctis sectionum F, H, K, ducendæ sunt F P, H Q, K R, parallelæ basi A D, quæ secabunt τετραγωνίζουσαν in punctis P,

Q, R. Tandem ex A centro quadrantis rectæ agendæ sunt in puncta Q & R, quæ divident arcum D V in proportionem triplam. Nam arcus V D, ex præsenti Theoremate est æqualis rectæ A F, & illius partes F H, H K, K A, sunt æquales arcubus V X, X Y, Y D. Quare cùm partes A F sint trientes, oportet & partes arcus V D esse trientes, rectamque A F, & arcum V D, divisum esse in proportionem triplam. Tandem si arcus datus quadrante sit major, oportet primum quadrantem, deinde reliquum arcum secare in proportionem datam, & partes quadrantis singulas, singulis partibus arcus reliqui addere, sic enim dividetur arcus propositus in proportionem datam. Atque ita etiam est procedendum, cum peripheria datur duobus, vel tribus quadrantibus major; nisi quod partes quadrantis secti in proportionem datam vel bis, vel ter sumendæ sint, prout peripheria data vel duobus vel tribus quadrantibus est major.

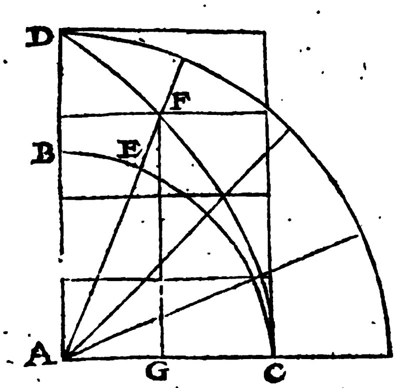
Est autem præsentis porismatis in Geometria magnus usus. Primum enim ipsius adminiculo quæcunque figuræ, sive parium sive imparium laterum, circulo dato inscribuntur; circulusque ipse, & quævis ejus peripheria data, in datam proportionem dividitur.

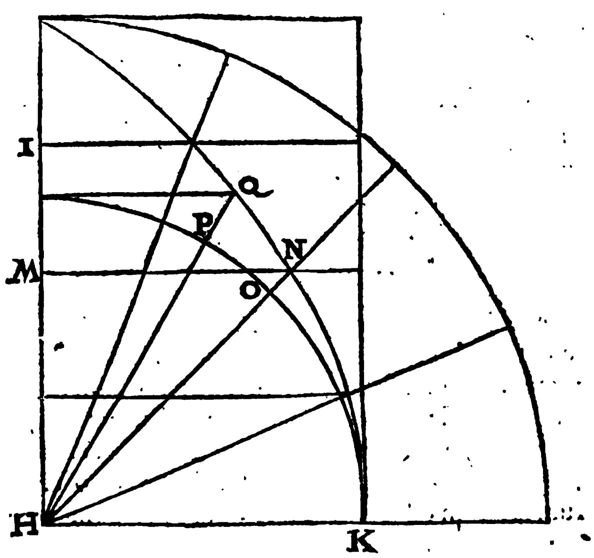
Secundò quivis angulus datus potest dispesci in proportionem datam. Quia enim per 33. Sexti Euclidis arcus ad arcum est, ut angulus ad angulum, haud dubiè quod de arcubus est demonstratum, de angulis una opera demonstratum esse oportet.

Tertiò Triangulum Isosceles construi potest, cujus uterque æqualium angulorum ad reliquum habeat proportionem datam: Unde etiam artificium pendet quamcunque figuram circulo adscribendi: quod tamen, ut Proclus censet, difficile est rudibus, quia multiplex & varium est opus.

PORISMA QUARTUM.

Postremò propositis duobus inæqualibus circulis, datoque arcu in alterutro, possumus æqualem abscindere ex altero; si modò utriusque circuli quadranti τετραγωνίζουσα sit adscripta. Oportet autem arcum in majore circulo datum, non esse minore circulo dato majorem. Nam si arcui dato inveniatur æqualis recta per primum porisma; & huic rectæ æqualis arcus in altero circulo, erit hic arcus inventus arcui dato æqualis.





Sint in præmissis figuris, A B C quadrans circuli minoris, & H I K majoris, quibus sigillatim adscripta sit τετραγωνίζουσα D C & L K. Deturque primum in minore circulo arcus E C, cui æqualis abscindendus ex majore circulo. Per primum porisma hujus elementi,

 per-

perpendicularis F G eſt æqualis arcui dato E C. Per ſecundum verò poriſma hujus, rectæ F G, cui æqualis eſt ipſa H M, eſt etiam æqualis arcus O K. Itaque per 11 Quinti Euclidis, arcus O K majoris circuli, & E C minoris ſunt æquales. Abſciſſus igitur eſt ex majore circulo arcus O K, dato E C in minore circulo æqualis. Quod faciendum erat.

Secundò detur in majore circulo arcus P K, cui æqualis abſcindendus ſit ex minore. Primum perpendicularis H I æqualis eſt, arcui P K per primum poriſma hujus. At per ſecundum poriſma rectæ A D (quæ facta eſt æqualis ipſi H I) eſt etiam æqualis arcus B C. Ergo per 11 Quinti Euclidis, Quadrans B C, & arcus P K ſunt inter ſe æquales. Abſciſſus itaque eſt ex minore circulo arcus B C, æqualis P K dato in circulo majore. Quod facere oportebat.

Atque ita pertractata eſt prima Cyclometriæ pars, de dimenſione circuli ambitus: ſequitur altera de dimenſione circuli areæ, que ſequenti libro eſt explicanda.

CYCLOMETRIÆ

LIBER II.

De dimenſione Circuli areæ.

1. *Altera pars Cyclometriæ eſt quæ benè metitur circuli aream.*

Hanc partem Cyclometriæ Græci τετραγωνισμὸν κύκλου, noſtri Quadraturam circuli appellant. Eſt autem nobile argumentum quod omnium ætatum Mathematicis propoſitum fuit, ut in eo ſe exercerent: pendetque à ratione diametri & peripheriæ; adeò ut ea inventa τετραγωνισμὸς κύκλου ſponte ſequatur. Itaque dubium non eſt, quin pars iſthæc Cyclometriæ perfacilis jam ſit futura, quia diametri & peripheriæ ratio, ſuperiore libro ſatis ſuperq; eſt demonſtrata.

2. *Aream circuli dimetiri, eſt non tantum circulo cuicunque dato æquale quadratum deſcribere, & cuivis quadrato dato æqualem circulum, ſed & rationem explicare quam circulus quiſque datus habet ad quadratum ſui diametri.*

Areæ circuli dimenſio vel Geometricè fit, vel Arithmeticè. Si Geometricè, deſcribere oportet quadratum circulo dato æquale, vel circulum æqualem dato quadrato. Sin Arithmeticè, explicanda eſt ratio quam circulus habet ad quadratum ſui diametri.

3. *Rectangulum cujuſvis circuli radio, & peripheriæ dimidio contentum, æquale eſt eidem circulo.*

Archimedes prima propoſitione μετρήσεως κύκλου demonſtrat omnem circulum eſſe æqualem Triangulo rectangulo cujus unum latus circa rectum eſt circuli radius, alterum perimeter. Demonſtratio autem ſumitur à dimenſione areæ cujuſvis polygoni ordinati, quæ à minimo ad maximum uniformiter ſe habet. Triangulum enim rectangulum cujus unum latus rectum ambiens eſt perpendicularis à centro polygoni in latus, & alterum perimeter polygoni, polygono æquale eſt. Cùm verò circulus ſit polygonum ordinatum infinitorum laterum, dubium non eſt, quin polygonum ordinatum finitorum laterum ad circulum quoque ſe extendat, quia eadem utrobique eſt ratio. Adeoque veriſſimum eſt quod Archimedes aſſerit, omnem circulum eſſe æqualem Triangulo rectangulo, cujus unum latus eſt circuli radius, alterum ipſius perimeter.

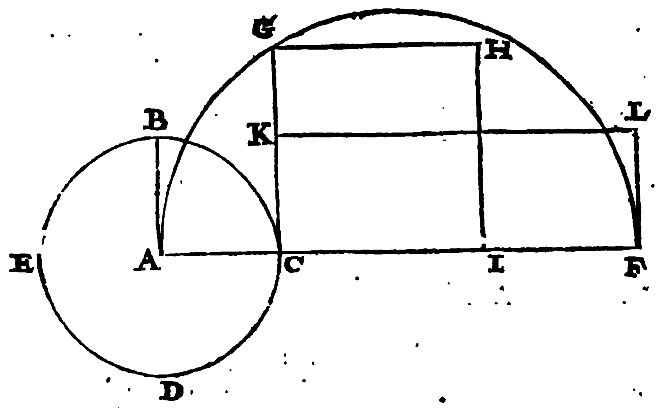
Hinc autem varia exſtiterunt Axiomata apud Theonem & alios, & inter cætera illud quod nos adduximus, *rectangulum circuli cujuſvis radio & peripheriæ dimidio contentum, æquale*

eſſe

esse eidem circulo. Cujus veritas cùm ex Archimedæo elemento, cognita parallelogrammi doctrina, sit manifesta, non opus est, ut pluribus ostendatur.

PORISMA PRIMUM.

Primò itaq; cuivis circulo dato licet describere æquale quadratum. Media enim proportionalis inter radium circuli, & semissem perimetri est latus quadrati, circulo dato æqualis.



Detur in adjuncto schemate circulus BCDE, ejusque radius A C, & semiperimeter C F per 1 porisma 5 Cyclometriæ, vel porisma 6 elemen. sitq; circulo dato describendum æquale quadratum; Dico mediam proportionalem inter radium A C, & semiperimetrum C F esse latus Quadrati dato circulo æqualis. Quadratum enim quod describitur à media proportionali, inter radium circuli A C, & perimetri semissem C F, æquale est (per 17 Sexti Euclidis) rectangulo quod continetur radio A B id est K C & perimetri semisse C F. Quoniam verò per præsens Theorema, hoc ipsum rectangulum, circulo B C D E æquale est; utique & Quadratum descriptum à linea media, eidem circulo est æquale. Inventâ igitur, per 13 Sexti Euclidis C G media proportionali inter radium A C, & semiperimetrum C F, datur quadratum C G H I, circulo B C D E æquale. Quod erat faciendum.

Manifestum verò est ex demonstratione præmissa, figuram quoque quamcunque rectilineam cuivis circulo dato posse construi. Nam si per præsens porisma dato circulo æquale quadratum construamus, & per 25 Sexti Euclidis, eidem quadrato figuram rectilineam æqualem, & similem alteri datæ rectilineæ figuræ; erit eadem figura rectilinea constructa dato circulo æqualis.

PORISMA SECUNDUM.

Secundò cuicunque quadrato dato describi potest æqualis circulus, si prius per præcedens porisma, cuivis circulo æquale quadratum descriptum sit. Quarta enim proportionalis descripti, datique quadrati lateri, & radio dati circuli, est radius circuli, dato quadrato æqualis.

Detur in adjuncto schemate quadratum A B C D, cui æqualis circulus describendus sit, sitque circulo A K I L ὡς ἔτυχε descripto, æquale quadratum, per præcedens porisma A F M N. Dico quartam proportionalem lateribus A F & A B, & radio A E, esse radium circuli, dato quadrato A B C D æqualis. Describatur enim recta linea E F ex E puncto in punctum F, & ex B puncto ducatur B G parallela ipsi E F, eruntque Triangula E A F & G A B similia, & latera Triangulorum, per 4 Sexti, proportionalia. Itaque

Ut A F ad A B, ita A E ad A G quartam proportionalem, lateribus quadratorum A F, A B, & radii A E.

Decircinetur quoque radio A G circulus A H I, eritque per demonstrata Pappi,

Ut